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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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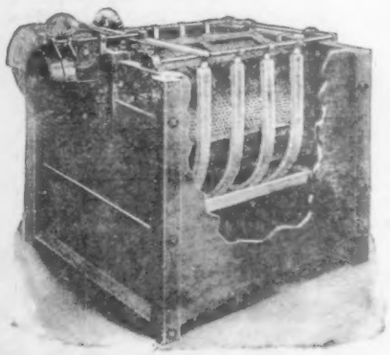

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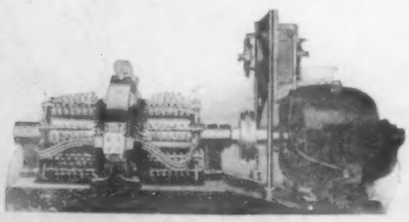

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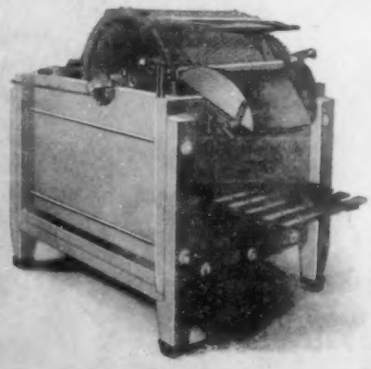

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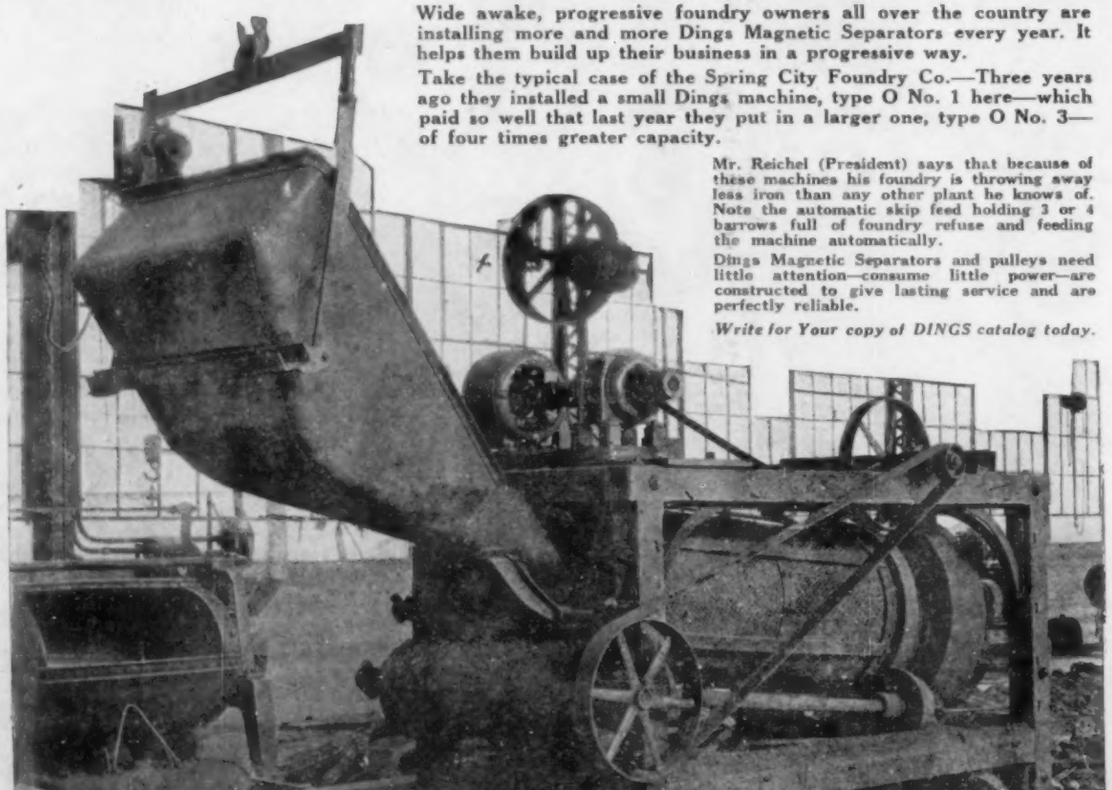

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ELECTRO-PLATERS REVIEW

Vol. 18 NEW YORK, NOVEMBER, 1920 No. 11

The Plating of Sheet Zinc

A Description of the Methods of Depositing Nickel, Copper Bronze, Brass, Silver and Gold on Sheet Zinc, as Worked Out by a Series of Experiments

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor.

In nickel plating zinc successfully there are several important factors to be considered. However, the general procedure is carried out as would be if sheet brass or copper goods were to be nickel-plated and the manipulations in polishing, cleansing and final finishing are identical.

POLISHING AND BUFFING

Articles made from sheet zinc should be cut down with tripoli composition; however, care must be used in cutting down that the metal is not overheated, as expansion blisters are liable to occur. Zinc expands readily under the influence of heat and pressure and as the metal cools rapidly the contraction is not uniform.

Kerosene oil has a beneficial lubricating action upon zinc, so a swab made up from a number of sections of buff discs rolled tightly together may be used to apply a little to the wheel occasionally during the polishing operations. It will prevent undue heating of the metal and it will be found that the zinc will come cleaner from the buffs.

If a high lustre is desired, then the zinc articles after **cutting down** should be buff colored on soft buffs. **White lime** compositions should be used for the purpose and the application of a little kerosene to the buff wheel will prove beneficial.

CLEANSING

Strong Alkali of the **Caustic** type should never be used in cleansing zinc. They have a reducing action upon the metal which destroys the finish and oxidizes the surface of the metal. Zinc articles which turn distinctly dark when cleansed in hot caustic soda solutions will never nickel plate successfully, as the oxide so formed is not soluble in the regular **Cyanide Dips** used in removing oxide from copper or brass when cleansed in the ordinary manner.

An excess of polishing dirt that accumulates upon the polished zinc, especially in the crevices and indentations, should be removed by immersing in gasoline, benzine or benzol, and using a soft brush of the painters' oval type. After cleansing, the zinc articles should be dried out by the aid of maple wood sawdust, and are then ready for the final cleansing.

ALKALI CLEANSING

Although **Caustic Alkalis** should not be used for cleansing zinc, small proportions are permissible in combination with milder alkalis. Oakite, Wyandotte and similar cleansing materials can be used successfully, but the proportions of such materials should not exceed 4 ozs. per gallon of water. The addition of ¼ oz Sodium Cyanide 96-98% per gallon of solution will be found an advantage as preventative of oxidization.

A very good cleanser can be prepared as follows:

Water	1	gallon
Tri Sodium Phosphate	3	ozs.
Soda Ash	2	"
Caustic Soda	½	oz.
Sodium Cyanide, 96-98%	¼	"

The temperature of the cleansing solution should be maintained at 180 to 200° Fahr.

A short immersion of the articles in the cleansers will remove surface grease. Following the alkali cleansing the articles should be washed thoroughly in cold running water and then immediately immersed for a moment in a Sodium Cyanide dip to remove any trace of oxide that may have developed upon the surface of the metal during the cleansing operation.

CYANIDE DIP

Water	1 gallon
Sodium Cyanide, 96-98%	4 ozs.
Temperature	normal

The articles should be rewashed in cold running water and are then ready for nickel plating.

NICKEL PLATING

The failures frequently resulting in nickel plating zinc come because the proper formula is not used. The ordinary combinations of single and double nickel solutions do not deposit the nickel quickly enough. The results are that the nickel deposit will frequently show blisters or black streaks that cannot be eliminated in the final polishing.

Zinc is a very electro-positive metal. In the ordinary nickel solutions it has a high resistance to conductivity; furthermore, due to its reducing action (and unless a very strong current is used) the nickel become precipitated upon the zinc as a nickel sulphide.

NICKEL SOLUTION

Water	1 gallon
Double Nickel Salts	8 ozs.
Sodium Chloride	4 "
Citric Acid	½ oz.

The solution should be prepared by dissolving the nickel salts in boiling water, using as little as possible for solution; then add the balance of cold water up to about 9/10 of the total amount; dissolve the salt and citric acid separately in the remaining water at 160° Fahr. The solu-

tion should be thoroughly mixed and is then ready for use. **Cast Nickel Anodes** give the best results.

The solution deposits readily at 2 volts and 20 amperes per square foot of surface without any streaks due to nickel sulphide and is easily controlled by addition of the three factors in concentrated form.

After nickel plating, the articles should be washed by the aid of cold running water and finally immersed in boiling water to assist drying.

FINAL POLISHING

The final coloring of the nickel plated zinc articles should be with soft unbleached muslin buffs. A good grade of white polishing composition should be used, such as White Diamond, Acme, etc. The use of a very little kerosene applied to the buff, as previously outlined, will be found advantageous.

It is the experience of many operators in nickel plating of zinc that if the articles are previously coated for a few moments in a brass solution the resulting nickel deposit is whiter; furthermore, it assures the operator that the surface is absolutely clean when the deposit of nickel is applied.

BRASS SOLUTION

Water	1 gallon
Sodium Cyanide	4⅓ ozs.
Copper Cyanide	3 "
Zinc Cyanide	1 oz.
Bicarbonate Soda	1½ ozs.
Ammonium Chloride	½ oz.
White Arsenic	2 grains

The solution should be prepared as follows: Dissolve the Sodium Cyanide in half gallon hot water, then add the copper and zinc cyanide, then add the balance of water cold except about four ounces, which should be used hot to dissolve the Ammonium Chloride. The Bicarbonate Soda should be added last. The White Arsenic should be dissolved in caustic soda solution and added only for brightening.

When thoroughly mixed, the brass solution is ready for use. Anodes of soft sheet or cast brass should be used, a voltage of 3 to 4 and amperage as required, for successful rapid deposits.

It is advisable to replenish the brass solution from a concentrated stock solution based upon the above proportions. However, it is advisable to reduce the amount of Zinc Cyanide given and increase the copper cyanide proportionately.

As a rule brass solutions in plating zinc require very little addition of zinc. The cleansing operations should be closely followed in brass plating as outlined for nickel.

COPPER SOLUTION

Water	1 gallon
Sodium Cyanide	4 ozs.
Copper Cyanide	4 "
Sodium Bicarbonate	1 oz.
Sodium Bisulphite	¼ "

Temperature of solution **normal** to 120° Fahr. Voltage 2½ to 3. Amperage, 15 per square foot of surface. The solution should be prepared as follows: In one-third the total amount of water at 160° Fahr., dissolve the Sodium and Copper Cyanide, then add the balance of the water cold. Now add the Sodium Bicarbonate and Sodium Bisulphite, thoroughly stir the solution and it is ready for use. Anodes of Cast Sheet or electrolytic copper may be used.

The solution will deposit a copper of intense red tone. To modify the tone or brighten the deposit add from 5 to 10 grains Sodium Hyposulphite per gallon solution.

BRONZE SOLUTION

Water	1 gallon
Sodium Cyanide	4¼ ozs.
Copper Cyanide	3 "
Zinc Cyanide	1 oz.
Sodium Bicarbonate	½ "
Sodium Bisulphite	¼ "

Temperature of solution normal or not more than 10° Fahr. Operate at 3 to 3½ volts, Amperage, 10-15 per square foot. Anodes should consist of sheet or cast bronze equal to the following proportions: Copper 88%, Zinc 10%, Tin 2%.

BRASS SOLUTION

Water	1 gallon
Sodium Cyanide	4¼ ozs.
Copper Cyanide	3 "
Zinc Cyanide	1½ "
Sodium Bicarbonate	¾ oz.
Sulphate of Ammonia	½ "
Sodium Arsenate	2 grains

Temperature normal, 3½ volts, 10 to 15 amperage per square foot of surface. Anodes of Cast or Sheet Brass, according to following proportions: Copper 70%, Zinc 30%, or Copper 66%, Zinc 34%. In preparing Bronze or Brass Solutions the method outlined for Copper should be adhered to.

Replenishing of solutions should be made from **concentrated solutions** of materials used in original formulas, the necessary amount of water originally used should be maintained in the tank and Sodium Cyanide added as free cyanide to keep up anode reduction as required.

SILVER SOLUTION

Water	1 gallon
Sodium Cyanide	4¼ ozs.
Silver Cyanide	3 "
Ammonium Chloride	¾ oz.
Bisulphide Carbon	2 grains
Caustic Soda	4 "

Temperature normal, 1 to 2 volts. Anodes of pure silver .999 Fine. Solution should be prepared by using one-third the amount of water at 160° Fahr., dissolve the Sodium and Silver Cyanide first then add the balance of the water cold, add the Ammonium Chloride and the solution is ready for work.

If the silver deposit is of a chalky white and slightly yellowish in tone, then take half an ounce of the solution, heat to 180° Fahr., dissolve therein the 4 grains of Caustic Soda and 2 grains of Bisulphate of Carbon per gallon of solution. This addition will bring up a white tone to the silver.

Replenish the solution when necessary with Sodium Cyanide, or equal parts of Sodium Cyanide and Silver Cyanide when metal is required to keep up the rate of deposition.

Sheet zinc may be plated direct by first using a **Silver Strike** and then plating in the regular solution as given.

SILVER STRIKE

Water	1 gallon
Sodium Cyanide	6 ozs.
Silver Cyanide	½ oz.
Caustic Soda	¼ "

Temperature normal at 4 to 6 volts.

Anodes may consist of **Sheet Steel or Carbon** on account of the high content of Sodium Cyanide. Silver anodes should not be used as the metal would be reduced too rapidly. Some operators, however, may prefer to brass plate the Zinc lightly, then lightly amalgamate with mercury and, after washing in clean cold water, plate direct in regular silver solution.

FORMULA FOR AMALGAM SOLUTION

Water	1 gallon
Sodium Cyanide	6 ozs.
Bichloride Mercury	¼ oz.

The solution is used as an immersion solution, no current being used.

GOLD PLATING

Water	1 gallon
Sodium Cyanide	½ oz.
Gold Trisalyt	½ "
Phosphate Soda	½ "
Bisulphite Soda	⅛ "

Temperature 140 to 160° Fahr., 2 to 2½ volts.

Anodes of fine gold 22 to 24 karat should be used to maintain the gold content of solution. Many platers, however, prefer to use Platinum Anodes, claiming that the color is more easily controlled with the Platinum Anodes. As Platinum Anodes are insoluble in Cyanide solutions, the gold solution must be maintained constant by the addition of Gold Trisalyt and other salts given.

Articles made from Zinc should always be **Brass Plated** previous to Gold Plating whether the finish is to be bright, satin or brush. The brass deposit, if a rich brass, resembles gold to a great extent and therefore will require **less** gold deposited upon its surface to give a uniform color than any other base metal. The time of plating may be from a few seconds upwards, depending upon the thickness of deposit of gold required.

For oxidized or Antique finishes, the commonly accepted methods can be used; for Copper and Silver, Polysulphide is used to advantage.

The Electro Plater will find that by following the methods outlined and the various solutions given he will be able to plate Zinc in the various metal deposits as readily as any other commercial metal.

Papers Read at the Foundrymen's Convention

Foundry Engineering by Frank D. Chase, Frank D. Chase, Inc., Chicago.

Notwithstanding the fact that not all efficiency engineers really promoted efficiency during the period when efficiency engineering was a fad, the influence of those engaged in the profession aroused the interest of foundrymen to the possibilities of improved methods. Industrial engineering, which followed efficiency engineering, recognizes the necessity of scientific analysis of the problems of plant layout and design to the end that a plant can be built to fit its operating requirements. The author emphasizes the need of making foundries attractive to workers, and at the same time designing the foundry so that the production possibilities of each department can be developed to the utmost. There is a great opportunity for economy in handling materials in foundries, and this subject is thoroughly covered by the author. Considerations affecting the choice of melting equipment are given and suggestions for cutting down molding costs are made. Methods of conserving labor in the cleaning rooms are outlined.

Physical Tests on Sheet Nickel Silver by Wm. B. Price, Ph.B., Chief Chemist and Metallurgist, and Philip Davidson, Metallurgist, Scovill Manufacturing Company, Waterbury, Conn.

The object of this paper is to present a survey of some of the physical properties of sheet nickel silver when subjected to cold rolling and when annealed at temperatures extending from 350° C. throughout the commercial annealing range.

A number of alloys were taken from stock and analyzed. Four of these, representing low nickel and high nickel both with and without lead, were chosen for the tests. The analyses were as follows:

Alloy	Copper, Per Cent	Lead, Per Cent	Iron, Per Cent	Nickel, Per Cent	Manganese, Per Cent	Zinc, Per Cent
A.....	64.68	Trace	0.194	6.73	0.06	remainder
B.....	65.82	1.27	0.227	6.17	0.06	remainder
C.....	65.44	Trace	0.345	17.83	0.08	remainder
D.....	65.60	1.08	0.238	17.77	0.06	remainder

These alloys were rolled in accordance with regular mill practice to approximately No. 6 B. & S. gage. The bars (which were then coiled) were annealed together in a mill muffle and afterwards pickled in a 10 per cent. sulfuric-acid solution and cold rolled in stages of approximately one number (B. & S.) at a time to No. 18 B. & S. gage. After each stage, suitable samples were set aside for physical tests. Additional samples were chosen for tests after the bars were rolled to Nos. 8, 10, 12, and 14 gage. These samples were annealed together in the mill muffle and, after pickling, were finished on 0.050-in. gage, yielding a series of specimens 2, 4, 6, and 8 numbers hard for the subsequent annealing tests.

Tensile test pieces 9 by 1 in. (22.9 by 2.5 cm.) were cut from both lots and the central portion was milled to give a test section 2½ in. long by ½ in. wide. A distance of 2 in. was marked off on the edge of each specimen with light punch marks. In the case of the annealed alloys, Erichsen test pieces 4 by 2½ in. were also taken. Results of tests are given in table and charts.

Transition Phenomena in Amalgams by Arthur W. Gray, Ph.D., Director of Physical Research, The L. D. Caulk Company, Milford, Del.

The thermal analysis of a metal or alloy is ordinarily made with the aid of heating and cooling curves, in which transitions are indicated by the rapid changes in curvature that accompany changes in the rate of heat absorption or evolution. Analysis by the method that depends on the change in thermal expansivity is not customary, partly, at least, because of the difficulties involved in making the necessary measurements. However, under certain circumstances, the dilatometric method of analysis may possess advantages over the thermometric method that will justify the additional trouble required.

The addition of 1 per cent of zinc to an alloy has been found to produce, upon the volume changes that take place during transition, effects that suggest the possibility of using the dilatometric method of thermal analysis as a rather sensitive means of obtaining chemical information. Although the illustrations presented in this paper are drawn from data obtained during an investigation of dental amalgams, similar phenomena can doubtless be observed with other alloys.

Zinc

Many automobile wheel rims are now zinc coated by the sherardizing process. This treatment retards rusting, which in the past impaired the life of the rims and caused occasional accidents due to fastenings giving away.

The world's largest and most completely equipped research laboratory devoted wholly to zinc is located at Palmerton, Pa. It is owned by The New Jersey Zinc Company and is operated both to develop new uses for that company's products and to render service to customers who desire to improve their manufacturing methods.

Investigation of Brass Foundry Flux

A Paper Read at the Columbus Meeting of the Institute of Metals Division, Oct. 5, 1920

By C. W. HILL,* Ph.D., T. B. THOMAS,† W. B. VIETZ,‡ Pittsburgh, Pa.

Fluxes, in general, may be classified according to their use as soldering, foundry or casting, and metallurgical and the chemistry of their action follows quite closely this division. The term foundry or casting fluxes, as used here, refers to the substances added to molten metals, preparatory to casting into molds or ingots, with the object of removing small amounts of impurities that have been introduced in handling or melting the metal, which was placed in a fair state of purity by the previous refining or metallurgical processes. The sources of these impurities are the oxide coating on the surface of the ingots, material extracted or mechanically removed from the crucible or furnace wall, and those formed by the reaction of the molten metal with the heating gases or furnace atmosphere.

As commonly used, the term fluxes is applied to such materials as ammonium chloride, zinc chloride, salt, borax, and boric oxide. A second class of materials, usually called deoxidizers, includes substances, such as metallic phosphides, sub-oxides, carbides, and borides, that reduce the metallic oxides present in the metal. A third class includes various compounds that are molten and non-volatile at the temperature of the molten metal and are used primarily to protect the surface of the metal from the action of the furnace or exterior atmosphere; to this class belong such mixtures as lime and fluorspar, lime and soda ash, various minerals, etc. In some cases these protective layers may act in a manner similar to the metallurgical fluxes and dissolve or unite with the oxide impurities of the metal, but as generally employed this latter action is negligible since there is little opportunity for the coverings to come into contact with more than the surface of the metal, and hence they are without action on the body of the molten mass.

The use of fluxes is the result of factory experience and tradition, but an extensive study has not been made of the chemical and physical actions that occur or the effects of these actions on the properties of the metal. It would seem necessary in any successful study of metal fluxes to determine not only what impurities are present in metals melted under commercial conditions, but the amount of these impurities. On account of the variety of metals used and their varying degrees of chemical activity, it will be necessary to consider the specific characteristics of each metal and its impurities as well as the properties that it has in common with the others. Thus, some metals are not only oxidized on melting, but have the property of dissolving their oxides. On solidifying, silver rejects the oxygen it has dissolved while molten, but copper does not. The extent to which aluminum will dissolve its oxide was unknown until the work of Rhodin.[1] The experiments made by the authors tend to confirm these results.

It is necessary to bear in mind the operating conditions, as in many cases impurities are not introduced in amounts at all approaching those possible by complete saturation, while in other instances the maximum is usually attained. The nature of the containing vessel and the time during which the hot metal is in contact with the container must also be considered. In general the impurities may be classified, as to source and kind, in the following manner:

SOURCE	NATURE OF IMPURITIES
From crucible	Combined or dissolved element
	Silicon, iron, carbon
	Suspended matter:
	Oxides from crucibles as SiO_2
From atmosphere	Oxides-nitrides:
	Dissolved
	Suspended
	On surface of metal
	Dissolved gases:
	Hydrogen, carbon monoxide
	Nitrogen, carbon dioxide, sulphur dioxide
	Water vapor

The properties of molten metal that may be influenced by these impurities are the melting point, surface tension, viscosity, amount of dissolved gases, and strength of the surface film. The properties of the cast piece that may be influenced are the mechanical strength, hardness, electrical conductivity, specific gravity, and coefficient of thermal expansion. The properties of the cast piece will be influenced by the properties of the molten metal when these properties concern the mechanics of molding.

The chemistry of soldering and metallurgical fluxing is well known, as is that relating to the action of deoxidizers in foundry fluxes. The chemical reactions of the ordinary fluxes, such as the volatile chlorides of ammonium and zinc, are not understood, and there is some question as to the extent of the chemical reaction, since it has been possible, apparently, to duplicate the action of these fluxes by mechanical means alone.

PHYSICAL CHANGES CAUSED BY FLUXES

The physical changes caused by the small amount of such fluxes as zinc chloride on a mass of molten metal, for example aluminum, are much greater than would ordinarily be expected from the chemical reaction of the small amount of flux. Assuming that we can write the equation for all the chemical reactions taking place when the flux is added, the real fluxing action must still be explained. The mere knowledge of existing chemical changes does not account for the physical changes observed.

In fluxing molten metal two phenomena are usually observed; viz., the metal appears to be less viscous and a varying amount of dirt or powder rises to the surface of the metal, which is skimmed off before the metal is poured. The common explanation for the first effect is that impurities have been removed from the metal, as evidenced by the accumulation of powder on its surface.

The true viscosity of molten metals is very low, being about the same as the viscosity of water, which makes the determination of absolute viscosity difficult and renders the determination of small variations in viscosity, due to the effect of dissolved oxides, well nigh impossible unless one goes to the most exacting extremes in apparatus design. The presence of impurities, sometimes suspended in the metal and sometimes dissolved, makes it impossible to use the capillary tube for testing the viscosity of flow, since these impurities soon change the cross-section of the tube and introduce errors of great magnitude. The value is so low that to measure the viscosity by the rotation of a cylinder within a cylinder necessitated the most delicate and frictionless bearings. The influence of the surface film on the rotating cylinder supports is suffi-

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[1] Trans. Faraday Soc. (1919), 14, 134.

ciently great to interfere with all tests. The experiments of the writers to determine viscosity and viscosity changes due to fluxing show that this property is but little changed by the process of fluxing, and that it is the change in the surface film which accounts for the apparent change in viscosity. A further confirmation of this lies in the fact that, in the case of aluminum, the writers have been unable to note any difference in chemical composition or amount of dissolved oxide before and after fluxing.

The dust or powder found on the surface is derived partly from the interaction of the flux with the molten metal, and not the oxide, and partly from the surface film. By surface film is meant not only the surface in contact with the atmosphere but the film that surrounds the molten metal as a whole, most of which is in contact with the walls of the retaining vessel. A large portion of the powder evidently arises from the walls of the crucible, a change in the strength of the surface film allowing it to become free and float to the surface. In the case of aluminum, no chemical reaction is possible between the fluxing chloride and the oxide of the metal; the effect of the flux is to change the strength of the surface film, probably by breaking it up mechanically by the violatization of the flux.

NATURE AND AMOUNT OF IMPURITIES

The complete experiments on the nature and amounts of impurities made by the authors are limited to the solid impurities introduced into commercially pure aluminum by melting in an oxidizing atmosphere in different kinds of crucibles, and to the solubility of hydrogen in molten copper and its alloys. The latter experiments form the subject of a separate paper, but are outlined here.

Aluminum was heated, without stirring, for 8 hr. at about 750° C. in different kinds of small crucibles placed in a Hoskins resistance furnace, the door of which was left slightly open. The results obtained are given in Table 1. The soaking action in these experiments was carried far beyond the point reached by even the poorest commercial practice. However, the tendencies of certain kinds of crucibles to introduce impurities is shown, as is the fact that even with prolonged heating in exposure to air aluminum does not take up much oxide from surface contact with the atmosphere. On prolonged heating in refractories containing even combined silica, reduction takes place with the introduction of alumina and it is conceivable that in commercial practice appreciable amounts of these impurities may be introduced. However, in common practice crucibles or refractories containing silica are not used in the melting of aluminum.

Table 1—Results of Heating Aluminum in Crucibles of Different Kinds

Crucible	Al_2O_3, Per Ct.	Fe, Per Ct.	Cu, Per Ct.	Silicon, Total	Per Cent. Graphitic
Original ingot	0.35	0.35	0.1	0.3	
Pressed steel	0.4	0.5	0.12	0.3	
Acheson graphite block	0.4	0.29	0.1	0.23	
Dixon graphite-clay	0.9	0.34	0.1	0.25	
Magnesia	1.3	0.36	0.13	0.3	
Clay	2.7	0.40	0.1	0.94	
Porcelain (glazed)	7.5	0.45	0.1	3.0	2.8
Sand	11.4	0.3	0.1	6.4	5.8
Fused silica	14.7	0.3	0.1	11.3	11.0[a]

[a] Crucible turned black in contact with metal.

The extent to which it is possible to load aluminum with its oxide, under certain conditions, is surprising. In the case of the extreme amounts, a microscopic examination showed that much of the oxide was suspended and not dissolved and that it was not uniformly distributed. A sample of so-called secondary, or recovered, aluminum, which had probably been made by a rather simple process of remelting aluminum turnings, was found to contain 2.27 per cent. Al_2O_3, 1.21 per cent. Fe, and only 0.25 per cent. Si, indicating that the melting had taken place in iron vessels, unless the refiner had carelessly failed to remove the free iron from the turnings before melting. With the ordinary remelting of finely divided aluminum, such as turnings, it is well nigh impossible to avoid the introduction of alumina. Commercial aluminum containing 0.1 per cent. copper was melted in a crucible with the careful addition of the same weight of fine turnings, care being taken to avoid oxidation as much as possible. After allowing the metal to stand for a short time, it was skimmed and poured. The oxide content was found to be 1.3 per cent. On repeating the experiment, adding the turnings and stirring in a manner calculated to be most detrimetal to the metal, the oxide content was 10.5 per cent.

The determinations of alumina were made, according to the method of Rhodin,[2] by dissolving in 10 per cent. NaOH solution and were checked by duplicate analyses, using 5 per cent. hydroxide solution. The agreement was satisfactory, being within 0.2 per cent. on samples containing 3.2 per cent. oxide. The method was substantiated in the case of several complete analyses in which the aluminum was determined directly; for instance,

	Sample No. 1 Per Cent.	No. 2 Per Cent.	No. 3 Per Cent.
Al_2O_3	0.43	7.2	10.5
Fe	0.29	1.2	1.4
Cu	0.20	9.5	9.5
Si	0.23	0.5	0.3
Al	98.5	81.3	78.7
	99.65	99.7	100.4

(Average of duplicate analyses on each sample.)

GASES IN MOLTEN COPPER AND BRASS

The amount of hydrogen that can be liberated from molten copper and its alloys upon solidifying and cooling to room temperatures has been determined.

Molten copper will absorb considerable hydrogen if exposed to hydrogen or if its surface or the containing graphite crucible is bathed with a gas flame; the amount absorbed is dependent on the temperature of the molten metal. A large portion of this dissolved gas will be given off in the process of solidifying and cooling. The amounts evolved at different temperatures of saturation are, approximately, as given in Table 2.

Table 2—Hydrogen Evolved from Copper at Different Temperatures

Temper. of Saturation, Degrees C.	Hydrogen Evolved Milligr. per 100 gm. Metal	Vol.[a] of metal per One Vol.
1100	0.600	3.33
1150	0.725	3.42
1200	0.85	4.00

Similar conclusions apply to copper alloys containing zinc or tin, or both, the amounts being as follows:

Copper in Brass, Per Cent.	Temperature of Saturation, Degrees C.	Hydrogen Evolved: Milligrams per 100 gm. Metal	Volume er One Volume Metal
95	1140	0.62	3.0
90	1100	0.52	2.2
85	1100	0.47	1.8
80	1100	0.41	1.6
75	1040	0.34	1.2
70	1000	0.17	0.75

[2] Loc. cit.

[a] Volume is at 760 mm. and temperature of solidification is 1083° C.

65	985	0.25	1.0
60	975	0.33	1.2
55	950	0.16	0.5
50	930	0.08	0.2
45	920	0.05	0.1
40	920	0.02	0.05
35	910	0.01	0.03
95 Tin 5 per cent.	1150	0.70	
90 Tin 10 per cent.	1150	0.60	
Red brass	1150	0.53	
Admiralty bronze	1150	0.56	
Yellow brass	1150	0.36	

Hydrogen will penetrate into the metal through many of the usual coverings but it is retarded by boric oxide and by a mixture of lime and soda ash. It is not retarded by a mixture of lime and fluorspar as is frequently stated. Dissolved hydrogen is removed as water vapor, to a large extent, by the addition of excess amounts of zinc oxide, or cuprous oxide dissolved in copper. Ordinary fluxes apparently do not have much, if any, effect upon it; nor do the metal scavengers called deoxidizers.

CHEMICAL ACTION OF FLUXES

Whatever chemical reactions we may anticipate in the use of fluxes may be considered in connection with the different classes of fluxes: chlorides, oxide slags, and deoxidizers.

Chlorides

The common chloride fluxes used are zinc chloride, ammonium chloride, and sodium chloride. With these chlorides two possible chemical reactions may be expected —that between the chloride and the oxide of the metal and that between the chloride and the metal itself. These would be illustrated, in general, by the equations:

With oxides $MO + ZnCl_2 = MCl_2 + ZnO$

$MO + 2NH_4Cl = MCl_2 + 2NH_3 + H_2O$

$MO + 2NaCl = MCl_2 + Na_2O$

With Metals $M + ZnCl_2 = MCl_2 + Zn$

Zn may then alloy with excess of the metal.

$M + 2NH_4Cl = MCl_2 + 2NH_3 + H_2$

$M + 2NaCl = MCl_2 + 2Na$

Sodium volatilizing or alloying with the metal.

An explanation of the action of these chlorides in fluxing is commonly given in the literature in accord with the first group of equations. The chloride fluxes, by reaction with the oxide impurities in the metal, convert these to chlorides which are either volatilized out of the metal or float to the surface. Anyone who has experienced the somewhat slow alloying of metals of nearly the same gravity would find it difficult to believe that in the incredibly short time of action of these fluxes, small quantities of these volatile materials can be added to the surface of a molten metal and by stirring be made to diffuse through the mass of the metal so that the disseminated oxide molecules are sought out and brought into chemical reaction. Such chemical reactions between the oxides and chloride fluxes are in many cases quite possible and may occur to some extent in fluxing. It must be quite apparent that this is not the main action involved since, in the case of aluminum, there is no action between aluminum and these chlorides at the temperatures involved in fluxing, yet ammonium chloride and zinc chloride are commonly used in aluminum casting and produce marked and almost instantaneous effects on the molten metal.

This rapidity of action and the resulting physical effect, which is apparently all out of proportion to the amount of flux added, are shown best when zinc chloride is added to a sluggish bath of aluminum which is somewhat impure or to a hot mass of finely divided aluminum chips or grindings that have been heated above the melting point of the metal but which refuse to coalesce. The addition of a relatively small amount of zinc chloride gives the effect of suddenly acquired fluidity to the bath, while the small particles in the second case unite rapidly to form a quantity of molten metal. The second case probably shows the way to the real explanation of fluxing, since in this instance we are dealing with a surface phenomenon and the flux does not have an effect on the interior of these small particles. The time element points away from a purely chemical explanation of fluxing.

The second group of equations, while possible in many cases, would not suffice as an explanation involving the removal of impurities in the metal. For the sake of completeness, however, it may be well to test these reactions to know which can take place at the temperatures commonly used. This may be done in a qualitative way quite readily and if an action takes place the temperature at which it becomes apparent may be recorded.

A summary of a group of experiments made by heating the reacting substances in suitable tubes and sweeping away volatile products by an inert gas (nitrogen) is given in Tables 3 and 4.

Table 3.—Oxides with Fluxes

Oxide	$ZnCl_2$, Degs. C.	NH_4Cl, Degs. C.	NaCl, Degs. C.
ZnO	400	400	No action
PbO	350	350	No action
SnO_2	350	300	No action
Al_2O_3	No action	No action	No action
Cu_2O	550	350	780-800 (chlorine evolution[a])
CuO	550	350	900 (chlorine evolution[a])
Fe_2O_3	No action	500	No action
Cr_2O_3	No action	500	No action
Max. temp. of experiment	1000	1000	1000

Table 4.—Metals with Fluxes

Metal	$ZnCl_2$, Degrees C.	NH_4Cl, Degrees C.	NaCl, Degrees C.
Zinc	No action	400	No action
Lead	350	350	No action
Tin	300	300	No action
Aluminum	400	400	No action (?)
Copper	300	350	850
Iron	500	400	1000
Chromium	1000	450	1000
Max. temp. experiment.	1000	1000	1000

FLUID COVERS

The object of coverings is supposedly to protect the metal from gases, although some coverings have been added with the intent to duplicate the metallurgical fluxes or slags by uniting with the metallic oxides present. Thus in melting fine particles of aluminum, cryolite mixtures are used with the intent of dissolving the oxide layer on the particles. Such uses are, however, not a regular foundry practice and belong in the field of metallurgical fluxes.

It sometimes happens that a covering for molten metal will dissolve the metallic oxides present to some extent. Coverings containing borax or boric oxide are especially active in this manner. The action is limited by the amount of stirring or circulation of the metal, since the reaction takes place only at the surface. It is conceivable that the metal near the surface would have its oxide content lowered by solution in the covering, which would cause a diffusion of the oxide from the interior portions richer in oxide, until in time we might have quite an appreciable amount of oxide dissolved in the covering.

A sample of impure commercial No. 8 aluminum alloy was melted under boric oxide for 30 min. with frequent stirring with the apparent change indicated by the following analyses:

[a] Cuprous oxide reacts with sodium chloride at 750° to 800° with formation of cuprous chloride and evolution of chlorine. Chlorine is also evolved when cupric oxide is heated to 900° with sodium chloride due to the decomposition of the cupric chloride formed by the original reaction.

	Al_2O_3	Fe	Si	Cu
Original metal	2.27	1.21	0.25	7.7
After melting	1.7	1.4	0.28	7.7

The oxide was determined after the method of Rhodin[3] by solution in 10 per cent. sodium hydroxide solution.

The object of protecting the metal by molten coverings is frequently not attained since many of the common coverings are penetrable readily by hydrogen, and in crucible furnaces hydrogen will pass rapidly through the walls of the hot crucible.

DEOXIDIZERS

The chemistry of the deoxidizers is well known. As a class they are either metals or compounds capable of uniting with oxygen with evolution of a great amount of heat and thus able to take oxygen away from the metals which have a lower heat of oxide formation. Their oxides are either volatile, as phosphorous oxide, or rise to the surface of the molten metal from which they may be skimmed. The amounts required depend on the amount of oxide impurities in the metal to be treated. Studies on the amounts of deoxidizers required or of the relative efficiencies of the different deoxidizers must be undertaken with proper control of the melting conditions, and it should be borne in mind that conclusions reached under one set of conditions do not necessarily apply under other conditions. In the following experiments, the effort was made to maintain conditions constant.

Various commercial deoxidizers were added to the highest grade lake copper. The copper was raised to the pouring temperature 1150° C., the deoxidizers added, the metal rapidly stirred, and the metal held without stirring at the pouring temperature for 20 min. before pouring into sand molds. The melting was done in an electric furnace of the carbon resistor type, so designed as to reduce the absorption of gases to a minimum. The metal was poured into sand molds to give bars for conductivity tests (½ by 18 in.). Samples of the bars were taken for microscopic examination.

The percentages of deoxidizers shown in Table 5 are those of active material added on the basis of chemical analysis of commercial deoxidizers, which were approximately 15 per cent. phosphor-copper, 10 per cent. copper-silicon, 24 per cent. manganese copper, 99 per cent. aluminum, 100 per cent. zinc, 100 per cent. magnesium. No analysis of boron carbide being available, the additions were made as of 100 per cent. active material.

Table 5.—Deoxidizers with Copper

Deoxidizers, 0.005 per Cent.	Per Cent. Cu_2O	Soundness of Copper Castings	Excess of Deoxidizer, Per Cent.	Electrical Conductivity
Si	0.3	Poor	0.0	
P	0.8	Fair	0.0	
Mn	0.8	Fair	0.0	
Al	2.0	Good	0.0	
Zn	2.0	Poor	0.0	
Mg	1.7	Fair	0.0	
B_6C	0.1	Poor	0.0	
0.05 per Cent.				
Si	0.0	Poor	0.0	
P	0.0	Good	83.4	
Mn	2.0	Good	Small amounts	
Al	0.0	Fair	Some	
Zn	0.5	Fair	0.0	
Mg	2.0	Fair	0.0	
B_6C	0.0	Good	0.0	95.7
Ce	3.0	Poor	0.0	

[3] Loc. cit.

Deoxidizers 0.05 per Cent.				Dissolved Deoxidizer (Coring)
Si	0.0	Good	0.0	Slight
P	0.0	Fair	Some	Much
Mn	0.0	Fair	Some	
Al	0.0	Good	0.0	Some
Zn	Considerable	Poor	0.0	Slight
Mg	0.0	Fair	0.0	Very slight
B_6C	0.0	Fair		

Oxide formed by action of the deoxidizer and remaining in the metal was found with aluminum, zinc, and magnesium.

The results obtained are not satisfactory since few of the castings made could be machined into a fine rod for conductivity measurements, weakness, and internal blowholes developing upon machining. Since every effort was made to prevent absorption of gases, it is probable that the difficulty came from the molding sand or the method of casting. The authors, therefore, would not attempt to make any comparisons as to the efficiency of the various deoxidizers from a commercial standpoint without a very careful repetition of these experiments. Under the conditions of use, which apparently were not the best, copper phosphorus and boron carbide appeared to be superior to the other deoxidizers.

The results may be of interest as indicating the conditions of equilibrium. Thus, 0.005 per cent. of active deoxidizer was insufficient in all cases for the complete removal of the copper oxide. Copper oxide was completely removed by the silicon, phosphorus, aluminum, and boron carbide added in amounts of 0.05 per cent. of the weight of the copper and there was no excess of deoxidizer apparent in the case of the silicon, phosphorus, and boron carbide. Manganese did not remove the oxide, although added in excess, while this percentage of zinc or cerium was not sufficient to remove the oxide; 0.5 per cent. of deoxidizer appeared to be more than was required for the removal of copper oxide, with the exception of zinc.

DEOXIDATION WITH AMMONIA

Some experiments were run by bubbling dry ammonia gas through molten copper. It was found that the ammonia removed the copper oxide in 15 min. or less but in so doing saturated the metal with hydrogen. With the particular molds and sand used, it was nearly impossible to control the rate of cooling and to provide for the removal of the dissolved gas. As a result the test pieces were very porous. One piece was obtained which machined nicely and was quite sound. The electrical conductivity (volume) was 93.98 per cent.

DEOXIDATION BY ALLOYING METALS

The addition of many of the common alloying metals to copper accomplishes the removal of copper oxide. The alloys thus formed are usually characterized by a selective oxidation in the molten state, the oxide of the alloying element forming instead of copper oxide. The study of the equilibria between various pairs of common elements and oxides at temperatures corresponding to the pouring ranges of the commercial alloys affords an interesting field for research; the authors have prepared samples that are awaiting analysis.

Zinc was found to reduce Cu_2O at 450° C.; tin, between 600° and 800° C.; while lead was without reaction at temperatures below 360°. These reductions should be borne in mind in considering the nature of oxide impurities which form by oxidation of the molten metal, thus as long as brass contained free zinc we should expect to find copper oxide as an impurity.

PHYSICAL ACTION OF FLUXES

As stated before, the physical action of fluxes is very rapid and appears to be greatly out of proportion to the

amount of flux added. In discussing the effects of fluxes, it is necessary to consider each class separately. We have no evidence that the chloride fluxes produce any change in the composition of the metal, the chloride coverings may remove metallic oxides to some extent, while the deoxidizers accomplish this result much more effectively. The physical effects of the chloride fluxes will then be largely and of considerable practical importance. The changes produced in the metal in the second class are incidental and need not be considered here. In the case of deoxidizers there is more or less complete removal of oxide impurities. If these oxides are merely suspended or physically mixed with the metal, the physical changes in the metal will not be great except where a surface change is produced at the same time. If, however, the deoxidizer removes an oxide from solution in the metal such physical properties of the metal as melting point, viscosity, and surface tension may be changed. These changes on the molten metal are likely to be small in comparison with surface changes. Their effects on the physical properties of the cast metal, on the other hand, may be great, as in the case of copper in which they change nearly all of the mechanical properties and the electrical conductivity.

The surface of many molten metals becomes covered with a surface film of mixed oxide and metal. While the thickness of the film appears to be greatest where it is in direct exposure to the air, it seems to surround the molten metal more or less completely. The effect on the mobility of the molten metal is to give an effect of increased viscosity. It is similar to surrounding a mass of water by a thin rubber wall. The mobility of the mass would be changed greatly while the rubber wall would be without effect on the viscosity of the water. The tenacity of the surface film is very great in the case of aluminum. With copper, the film does not form to a similar extent on account of the solubility of the copper oxide in molten copper. There must, of course, be some affinity between the oxide and the metal, at least sufficient to cause wetting, or the film would not be tenacious. In handling the metal, the increased viscosity due to the film has undesirable effects, such as interfering with proper stirring and preventing the metal from flowing freely into and filling in sharp corners of a mold.

The effect of the film is noticed in attempting to melt finely divided metal, such as aluminum. The metal may be heated considerably above its melting point without the particles coalescing. They may become almost spherical and consist of molten metal surrounded in a bag of surface film. The globules may touch each other but the films prevent the metal from collecting in larger particles. If the films are broken mechanically, the particles will unite. The effect of fluxes upon these films has already been discussed under the head of chemical action. In the case of aluminum, the chloride fluxes cannot react chemically with the film itself; they may react with the metal underneath if they are able to penetrate through the surface film.

We are, therefore, forced to the conclusion that the real action of such fluxes is physical in nature. It may be largely mechanical. That is, the rapid evaporation of the flux at the points of contact with the surface film may mechanically break the film, allowing the molten particles to unite. The flux may penetrate through the film and react with the metal below, giving a volatile substance which disrupts the film. Since the fluxes themselves and the volatile products, possibly by a chemical reaction, are of about the same volatility, this explanation does not appear to hold. In certain experiments, the writers have conducted vapors of these fluxes over oxide films on finely divided particles of aluminum without causing the union of the particles. On the other hand, it has been possible by suitably protecting the finely divided metal particles from oxidation to cause a complete coalescence by mechanical means without addition of a flux. This mechanical explanation was long ago advanced by Gillett, after considerable experience in the melting of aluminum filings and turnings. The authors have been able to cause good fluxing of finely divided aluminum particles by adding aluminum chloride, which is the reaction product of any possible chemical reaction with the original chlorides and which is itself without chemical action on the metal or the oxide.

Another possible explanation would be the partial solution of the surface film in the thin layer of molten flux that exists before the flux is volatilized, which causes a weakness in the film and allows it to break. We have no experimental evidence on this.

Making Pipe Bushings from Standard Pipe*

By W. F. SCHAPHORST

It is a good thing to know that bushings can be made out of standard pipe. Many pipe fitters don't know that it can be done. Or, if they know that it can be done they don't know the correct size of drill to use for tapping. I have always known that it can be done and have occasionally made bushings out of pipe, but each time I found it necessary to first look into my handbook for the drill size to use and that is so much trouble that it is frequently easier to go to the store and buy a new bushing. Recently, though, it has been very difficult to buy bushings in stores on account of shortage of all pipe fittings, hence I feel that the following information should be of much value. I have collected all of the data together for all bushings that can be made out of ordinary sizes of extra heavy and double extra heavy piping.

To bush from ¼ in. to ⅛ in., for example, get a piece of ¼ in. extra heavy pipe sufficiently long for cutting the outside thread. Then cut the end off to the desired length, drill or ream with a 21/64-in. drill (diameter of drill 0.328 in.) and then tap with a ⅛-in. pipe tap.

The table enclosed tells the complete story for all ordinary sizes: Note that in one case, ⅜ in. to ¼ in., the internal diameter of ⅜ in. extra heavy pipe is such that no drilling is necessary.

Also note that in bushing from ½ in. to ⅜ in. either extra heavy or double extra heavy piping can be used.

To Bush From	Use This Size of Pipe	Use This Size Drill or Reamer
¼" to ⅛"	¼" Extra Heavy	21/64" Drill = 0.328"
⅜" to ¼"	⅜" Extra Heavy	None
½" to ⅛"	½" Double Extra Heavy	21/64" Drill = 0.328"
½" to ¼"	½" Double Extra Heavy	27/64" Drill = 0.422"
½" to ⅜"	½" Double Extra Heavy	9/16" Drill = 0.562"
½" to ⅜"	½" Extra Heavy	9/16" Drill = 0.562"
¾" to ⅜"	¾" Double Extra Heavy	9/16" Drill = 0.562"
¾" to ½"	¾" Double Extra Heavy	11/16" Drill = 0.688"
1" to ¾"	1" Double Extra Heavy	29/32" Drill = 0.907"
1¼" to 1"	1¼" Double Extra Heavy	1⅛" Drill = 1.125"
1½" to 1"	1½" Double Extra Heavy	1⅛" Drill = 1.125"
1½" to 1¼"	1½" Double Extra Heavy	1-15/32" Drill = 1.468"
2" to 1½"	2" Double Extra Heavy	1-23/32" Drill = 1.72"
2½" to 2"	2½" Double Extra Heavy	2-3/16" Drill = 2.187"
3" to 2½"	3" Double Extra Heavy	2-9/16" Drill = 2.562"
3½" to 3"	3½" Double Extra Heavy	3-3/16" Drill = 3.187"
4" to 3½"	4" Double Extra Heavy	3-11/16" Drill = 3.688"
4½" to 4"	4½" Double Extra Heavy	4-3/16" Drill = 4.187"

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A Novel Core Oven

A Paper Read at the Columbus Meeting of the American Foundrymen's Association, Oct. 5, 1920

By STEPHEN B. PHELPS, Pittsburgh

In an implement foundry in which trouble had been experienced because of the warping of rails and cars in a car-type core oven, the author was called upon to design a new oven. Instead of using the usual track to support the core truck, he designed and constructed overhead tracks, from which two trucks were suspended on trolleys. When one truck is in the oven, the other is in position for loading or unloading. It is claimed that with the tracks, trolleys, bearings, etc., overhead, there is no chance for warping or twisting. The truck is described in more or less detail in the paper.

Foundry superintendents in the past were not only expert in foundry practice but were required to have ability to design and construct their equipment as well. The present day foundryman as a rule does not have to use his ingenuity in designing machines, ovens, etc., because the many equipment manufacturers with their numerous standardized designs can usually supply his needs from stock and thus allow him to concentrate on such matters as production and quality of castings. However, it sometimes happens because of lack of space, peculiar operating conditions, or immediate needs, that the foundryman still has to be his own engineer. Such was the case when the writer was called upon to replace an oven which had been blown up, due to the carelessness of the colored operator, shortly before the writer took charge of the shop.

HEAT WARPS TRACKS AND TRUCKS

One of the disadvantages of oil burning for baking cores— especially, if as in this case there is not enough room for a well designed combustion chamber—is the intense heat developed which causes frequent relining of the combustion chamber. If the oven is of the truck style with wheels attached, and especially if the burner operates between two trucks, the rails, wheels and truck itself may be cracked and twisted out of shape by the heat.

Due to the lack of space the trucks in this oven were crowded too close together and the heat cracked the wheels, warped the truck frame and twisted the rails to such an extent that the repairs were very excessive. It frequently took about 20 men with chains and a man on each wheel with a bar to get the truck out and sometimes even this gang gave up. When properly lubricated the truck described below can be pulled out by two men.

The truck does not run on rails but is carried by trolleys which run on overhead I-beams. This novel idea eliminated the trouble in operating the trucks by placing the running gear and tracks where the heat could not affect them.

The new design besides giving quick service for cores, pays for itself in about two years by very greatly reducing the cost of repairs and the saving of the time of the excessive number of laborers and coremakers required to move the trucks.

The trucks are designed with the doors attached forming the end of the truck so that when one truck is drawn out for a new load, the back end of truck acts as a door and closes the oven, permitting access to one truck while the cores on the other truck are baking. This presented another problem in design as the trucks could not be drawn completely out of the oven and in this case it is not practical to build a longer oven or design another complete truck. In order to overcome this difficulty the writer des gned two brackets for carrying the front end of the truck and a similar pair for the back end, but in this case the brackets and the trolleys extended through the rear wall, cast iron covers being designed to enclose them. This permitted the use of the entire oven space and the former truck frame which was designed with adjustable bars for carrying cores of different sizes.

CONSTRUCTION OF OVEN

The construction for the new oven for overhead travel consists of three columns erected along the side of the oven and three cross beams supported by the columns and the wall on the other side of the ovens. Four I-beams are suspended by turnbuckles from the cross beams to act as tracks for the trucks. The tracks are kept from swaying when the trucks are moved by braces connecting them with the columns and walls. Turnbuckles are used to suspend the tracks to insure their being level and to make them adjustable in case anything should throw them out of line. They are convenient but a less expensive hanger could be used. The three columns are tied together with a long angle and the same shapes are used as braces from the columns to the tie piece. The cross beams are tied to the wall with bolts.

It may be thought that these structural pieces were an additional expense aside from the building of the oven However, it will be seen that in nearly each instance they or some other shape would be required if the usual type of oven were being built and some other pieces not required in this design would be used in addition. For instance, the overhead I-beams replace the tracks in the floor and do not require the customary metal ties or spreaders, nor the customary cement foundation which usually also means a cement floor. The columns replace the customary buckstays and the cross beams replace tie rods, although their costs no doubt are greater.

Three doors were hung on hinges on the walls of the oven to permit observation of the cores and the combustion. They also act as a vent so that the doors can blow open in case another careless operator causes an explosion. Standard trolleys were used in this case but they are not designed for such service and should be provided with special means for convenient lubrication in such close quarters.

Plating Hints*

Question No. 1. Would it be advisable to silver-plate aluminum reflectors commercially?

Answer. No; furthermore, there is no advantage of making aluminum reflectors as long as they have to be silver-plated.

Question No. 2. In calculating electro-deposits by Faraday law, what percentage of the current used should be figured in depositing metal from cyanide solutions?

Answer. That depends entirely on the efficiency of the solution. All cyanide solutions with the exception of silver operate at a pretty low efficiency.

*The Monthly Review, October, 1920.

Notes on Brass Foundry Practice at Messrs. Vickers, Ltd. Barrow-in-Furness

Part 1 of a Paper read at a Meeting of the Institute of Metals held on September 15, 1920, at the Town Hall, Barrows-in-Furness, England

By H. B. WEEKS, F. I. C., Member of Council (Barrow-in-Furness)

A retrospect of the progress of almost any long-established undertaking cannot fail to reveal, to an astonishing degree, the multitudinous efforts and anxieties which go to constitute both the foundation and the structure.

The development of a foundry is to a very large extent relative to compliance with its periodical requirements, consequent upon an essential policy of competitive adaptation.

It is intended in these notes to review the growth of the brass founding industry in Barrow.

Previously to the early 'seventies, brass founding was practically unknown in Barrow. Its industrial birth synchronized with the commencement of operations by the Barrow Iron and Steel Shipbuilding Company about the year 1871, *i.e.* nearly fifty years ago. The brass foundry then consisted of a small and very badly ventilated shop, the dimensions of which were about one hundred and twenty by thirty feet. Twelve crucible fires were contained, and one reverberatory furnace of 5 tons melting capacity, with a total output of 5 tons per week. In 1897 the Vickers firm took over the control of the works, and work of every description was undertaken.

Loose Pattern Molding.—The method of molding mostly in vogue at that time was what is known as "loose pattern." The elementary nature of the shop tackle made an entire overhaul in that direction necessary, so that an increased output might be expected. Loose pattern molding may be divided into two classes, viz. molds made in "dry sand" and in "green sand." The former, generally used in connection with castings of heavier design, receive stove treatment, which renders the impress of the mold impervious to the metal and other pressures due to the casting operation; also the castings are expected to machine out well, and in many cases to withstand a high-water test pressure. "Green-sand" molds are made in specially prepared sand. Patterns of thin section, and therefore of not much weight in the casting, may be made by this method without having to be stoved at all, as direct contact between the smaller volume of molten metal and the walls of the mold produces no damaging results.

Whilst loose pattern work of either of the types to which reference has just been made was at that time the general method of procedure, it will be understood that, on the one hand, stoving the mold was costly and occupied valuable time, whilst on the other hand the suitability of light work only for "green sand" was a handicap.

The manufacture of a loose pattern often entails a lot of building up in segments to make it rigid and durable for subsequent foundry treatment—this also increasing the cost. It was therefore necessary to reorganize loose pattern molding from the manipulative standpoint if increased output was to be obtained. By this means, then, there came into operation here the practice of molding on plates.

Plate Molding—This has proved to be a most economical method, even where there is not any lengthened period of repetition work; patterns with quite a limited number required from them can be profitably put on plates, and economies effected, both in pattern shop and foundry. The system has been applied here to such an extended degree that there are now twenty thousand mounted for the brass foundry alone.

When the patterns are assembled on the plate ready for securing, the foundry foreman decides the position of the gates, runners, and risers. The patterns, gates, &c., are then securely fastened on the board or plate, and if any further instructions are necessary for the guidance of the workman they are usually typed on the plates, thereby ensuring a continuancy of the method established, no matter to which molder the work may at any future time be entrusted. Moreover, in many cases, only one-half of a pattern need be made and mounted on the plate, as this can be set with such accuracy that both bottom and top halves of the mold can be made from it. The practice in the foundry is to have all the molding-boxes drilled to jig, so that the boxes in their own class may be interchangeable. These boxes, made in various sizes, are assigned a special denomination to distinguish them from each other, and the same denomination is engraved upon the plates, so that they can be readily recognized. When in the hands of the molder, he may probably ram up a dozen bottom parts before he starts with the tops, all the time only using one set of guide pins, dropping them through the slots in the molding-box into the holes in the plate, thus keeping them in relation with each other until the box is rammed up and the plate withdrawn from the box. The same process is adopted when placing the top half of the mold on the bottom half. As there are only four-thousandths clearance on the pins, it will readily be understood how accurately the parts must register when placed together.

The castings are a faithful representation of the pattern, correct in every detail, and production is enormously accelerated. The production is, of course, quite dependent upon the assistance of all concerned, before, during, and after the actual manufacture of the casting by the molder.

Sectional Departments.—There are sectional departments at Barrow—e.g. for pattern receiving, book-keeping or identification, molding (referred to), core-making, metal mixing and melting, dressing or fettling, sand-blasting, and, lastly, dispatch. Each of these sectional departments is as perfectly organized as possible and takes its separate part in the scheme of increase, with the head-foreman's office as the governing body, and with a prescribed area of the shop floor upon which to operate.

Foundry Procedure.—If we follow a loose pattern from the moment it reaches the foundry until the casting is dispatched to the machine shop, it will be both explanatory and instructive.

In the receiving department a complete record of the details of the pattern is made. If no core is required in the molding, the pattern is immediately taken into the foundry to go in hand in due course. Should cores be required, however, the core-box is put into the hands of the foreman coremaker. We will assume, then, that the pattern is one for which cores are necessary, and that the core-box has reached its destination. The fore-

man molder sees the pattern, and decides whether it shall be made in "dry" or "green sand."

In order to follow a pattern offering the furthest insight into the method of procedure, we will assume that the pattern under consideration is to be treated in "dry sand," and has been therefore handed to a molder used to that type of work. Some men excel in "dry," others in "green-sand" work, and, in their respective positions, produce good results; otherwise, results are frequently disappointing, though it must in fairness be said that there are many men both good and reliable on both classes of work.

The "dry-sand" molder to whom our pattern has been given, takes the order ticket from it, to enable the card-writer to make out and give him his card for the job, preparatory to the rate-fixer's visit, regarding the basis time to be given for the work in question. The card-writer at the same time enters the name of the molder and the date and time of the commencement of the job on to the order ticket; this is then sent to the head-foreman's office to be entered in their books for the purpose of official progress. The order ticket bearing the molder's name is then forwarded from there to the dispatch, its receipt at this department intimating that the job is passing through the foundry and may be expected. Meanwhile, the molder has commenced operations on the pattern, and it will be necessary to assume that an interval has elapsed, that our mold has been made, and is now ready to be lifted on to the stove carriage to go through the drying process. It will be remembered, in connection with the pattern, that the core-box was taken charge of by the foreman coremaker; of this we are reminded by his arrival with a tally or ticket bearing the name of the coremaker who has made the cores, from whom they may be obtained by the molder when the mold has been drawn from the drying-stove, which we at this time will suppose has been done.

It is a regulation that each foreman must send in his application for metal on a printed duplicated form, verbal orders not being permissible. The foreman has ordered his metal for the mold in compliance with this; the necessary quantities have been weighed, checked, and wheeled to the crucible fires, to be put into the pots for melting and then filling the mold. This has been closed by the molders so as to be ready at about the same time as the metal. Our mold is cast, and allowed to cool.

Dressing, or Fettling.—Later, the mold is taken asunder, and the casting, after being checked by the overlooker, is transferred to the dressing or fettling shop. The first treatment it receives removes the major portion of any parts of the mold which may still be adhering; the cores are then knocked out, and the risers, gates, &c., are cut off by sawmen.

Sand-Blasting.—Further attention by the dresser and, later, sand-blasting, will finish our casting, ready for handling by those who are mainly concerned in its dispatch from the foundry. It might here be remembered that the order ticket for the casting had been forwarded from the head-foreman's office to that of dispatch, and that its receipt there would intimate the later arrival of our casting. The casting is weighed, the figures entered on the order ticket, and a label on to which the same details have been entered is affixed to the casting, after which the order ticket is released for commercial attention where, should the order be completed, it will be retained.

From the foregoing, the substance of the procedure traversed by a pattern and, later, casting through the foundry may be obtained, though there are subsidiary details also in connection with its progress not requiring mention here.

We will now give a little consideration to what must be called minor departments connected with the foundry, and whose duty it is to support those sectional departments just referred to during progress.

We have metal storing, extraction of metals from foundry waste by washing, sorting of scrap, melting and running into pigs for analysis and later storage, sand and loam mills, gas producers, tackle store, and, for general upkeep of foundry material, smithing, drilling, and joinering departments. Each of these, sectional and supporting, go to make possible the existence of each other, and therefore have some claim to mention in the general scheme of operations.

Loam-Molding.—It is now necessary to refer to two other methods of molding — loam-molding and molding in cast-iron chills. Loam-molding was resorted to on some of the large work of a design suitable for the method, chiefly on account of the avoidance thereby of pattern-making expenses. This will be better understood when it is explained that in the case of large patterns of thin section—as, say, marine condensers—the mold could be made cheaper in loam by the use of strickle-boards. The "dry-sand" method is preferred on most jobs, the exceptions being those on which the avoided cost of pattern-making is more than equivalent to the extra cost of molding. It will be gathered, therefore, that loam-molding has not been much practised in our brass foundry.

Chill-Molding.—With reference to molding in chills, this is resorted to for work of cylindrical contour and solid content, to be treated later by the forge people.

Bonus System.—It may be of interest also to note the introduction into the foundry of the Premium Bonus System, which, to judge by results presently obtained, undoubtedly encouraged production in all departments of the foundry. Its value was and is still considerably enhanced by the intelligent co-operation of rate-fixer and foreman in its application, evidenced by the satisfaction with which the scheme has invariably been received by the workman.

Metal Control.—One of the most important items is that of metal control, which is probably the predominant factor in the successful working of the foundry. Where there is a turnover of many tons per week, the greatest care must be exercised in order to avoid mistakes; and the metals, in whatever form they may be, must be perfectly controlled, not alone in the foundry, but also within the different machine and fitting departments where castings are sent. In the weighing-out department connected to the foundry all material is weighed under supervision—that is, in addition to the workman whose duty it is to weigh the metal, the weight is also checked by another workman before it is transferred to the foundry. In the foundry there is placed before each crucible fire and iron tray into which each full charge is placed. The trays are there to prevent any portion of one heat being accidentally conveyed into a neighboring heat and adversely affecting the composition of the alloys.

Scrap.—Scrap metal is not used a second time for the purpose of pouring into molds; it is collected in the foundry and dressing shop, carefully separated, and placed in its own denomination. It is melted down into heats, each heat being given a registered number, and is subsequently analysed before being released for foundry use.

All the high-class alloys or specialties are treated separately, and the scrap melted down to ingot form in plumbago crucibles in coke fires. Not only is the scrap from the various alloys kept separate and distinct in the foundry, but also throughout all the machine depart-

ments to where non-ferrous metals are dispatched the same great care is exercised in isolating the numerous alloys.

No better vindication is necessary of the accuracy in which all scrap metal from the machine-shops and foundry is dealt with than the fact that from analytical tests subsequently taken only very slight variations occur from the specified alloys. A list of the alloys in use, each being given a distinguishing mark or letter for purposes of identification, is available containing the physical tests or composition, and copies are filed in drawing-offices, pattern-shop, and foundry. Remarks based on foundry experience were added for the guidance of the drawing-office, in order to keep the designer in touch with the metallurgist and enable him to take advantage of any specific properties of a given alloy.

Melting.—During the process of melting the metal in the crucibles, great care is exercised to prevent oxidation, and charcoal is used to cover the metal, whilst a metal foreman is constantly in attendance, working under the personal supervision and instructions of the foundry chemist and metallurgist. Particular care is taken that the immediate area of the fires is kept clean and quite free from all scrap, and each fire-hole is fitted with a large cover, so that the metal is in an enclosed chamber during the melting process. Four of the crucible fires can be attended to by one furnaceman. The careful attention given by the workmen, qualified by efficient supervision, has done much to render the brass foundry as nearly immune as possible from the metal troubles so common to the industry.

It has been stated earlier in these notes, that a policy of competitive adaptation is essential to the progress of the foundry. The very apparent truth of this is specially applicable to the practice of molding by machine, with which subject we will now deal.

Machine-Molding.—The molding-machine has of late years more than justified its inclusion as a productive unit in the plant of a modern foundry. The necessity for increased production has made it imperative that the foundry should be equipped with machines of the most efficient type. It was at one time considered that their only hope of success lay in the direction of repetition work, but this supposition has now been proved a fallacy. The output of jobbing work treated on the molding-machines in the brass foundry here has been quite 75 per cent higher than when made on the floor. Much of this success, however, has been brought about by intelligent adaptation.

The somewhat hesitative acceptance of the molding machine as an aid to increased production, concerned in reality its supposed futility in dealing with jobbing work. Yet one might ask, how can it have increased the output of jobbing work by 75 per cent?

To explain this an extract has been taken from:

"Patent Specification, No. 134,327.

"Improvements in or Relating to Molding or Like Apparatus.

"This invention relates to molding-machines, the object being to render practicable the inexpensive machine-molding of single or small numbers of articles.

"According to the present invention there is provided a pattern plate corresponding in size to the maximum size of molding-machine table to be dealt with together with a molding-box which is also of maximum capacity, the parts of the pattern plate being provided with indexing means and being so constructed or arranged that any one or more of a variety of loose patterns can be attached as required at predetermined positions thereon. To this end the pattern plate, which, if desired, may be constituted by the table of the molding-machine, is provided with means for indicating the correct position that each pattern is to occupy thereon, such as a series of openings or perforations, hereinafter termed dowel holes, the said dowel holes preferably having index numbers and being located at predetermined distances part over the surfaces of the pattern plate. The patterns to be employed with the novel pattern plate may also be provided with means for indicating the correct position which they are to occupy on the pattern plate, such as two or more openings or dowel holes for receiving the dowel pins which secure the patterns in positions on the pattern plate, so that by referring to the index numbers on the dowel holes of the pattern, the correct position which each pattern is to occupy on the pattern plate will immediately be indicated."

The patent rights for this patent pattern plate were taken out some time ago by Messrs. Vickers, Ltd., of Naval Construction Works, Barrow-in-Furness, and Sir James McKechnie, K.B.E., director of Vickers, Ltd.

It is fitted to all the molding-machines of the jarring type in the brass foundry here, and its efficacy in dealing with work of a jobbing nature on the machines is plainly evident, even to the uninitiated. Jobs of most intricate workmanship, involving numerous cores, have been successfully made by its agency, and the appearance of both mold and casting could not have been improved upon. The economic principle of all machine tools is mass production, but more especially is this the case with the moulding-machine, the profits of which largely depend upon the cost and maintenance of the pattern plate. The invention referred to in the foregoing extract has a distinct bearing on the cost of pattern plates, as it entirely does away with the necessity for their manufacture as far as the molding-machine is concerned.

During the European War the demand for production to equip our naval and military forces, and those of our Allies, will not have been forgotten by any of us.

In this brass foundry, at that time, there were being turned out about eighty tons of brass castings per week. From August 1914 to November 1918 there were two million brass castings dispatched, some to our own shops here, and an enormous quantity to firms all over this country. The weight of these reached over sixteen thousand tons, which averages more than seventy tons weekly. Some idea of the proportions of our program may be realized by the statement that at one period our dispatch department handled well over twelve hundred castings each day for seven days a week. This was only rendered possible by continuous operations being carried out on the molding-machines installed.

We are now able to drop as many patterns on to the plate as will come within the area of the box part, and it is the general practice to fill in any vacant spaces that may be on the plate with a recast where only one is required.

This paper will be concluded in the December issue. —Ed.

SUCCESSFUL PLATING METHODS*

Question No. 1. What is the safest way to prepare white metal for nickel-plating?

Answer. Wash in gasoline, dry in hardwood sawdust, rinse in mild alkali, cleaner, cold water and put directly into a nickel solution.

Question No. 2. What brightening agent can be used in an 18K gold-plating solution?

Answer. Bisulphite of soda, hyposulphite of soda or pyrophosphate of soda.

*The Monthly Review, October, 1920.

Melting Brass With Fuel Oil

An Analysis of Costs and Comparison With Other Fuels, Showing That Fuel Oil Is the Most Economical —Conclusion*

Written for The Metal Industry by S. D. RICKARD, Consulting Engineer, Wayne Oil Tank and Pump Company

The system shown in Fig. 3 is practically the same in its operation as that described in the October issue, (see page 462). However, no air receiver is necessary with the type of blower used, as turbo, centrifugal or fan types of blowers do not produce pulsations in the flow of air. As these types of blowers are operated at speeds of 1,700 to 3,400 R.P.M., it is impractical to chain drive the oil pump from the blower shaft. Therefore, the oil pump is driven by a separate small motor. In order to avoid the danger of pumping unatomized oil into a hot furnace, due to failure of the air supply, an automatic cut-off valve is placed in the oil supply line. A branch air line is run to this valve. The operation of this valve is such that the pressure of the air holds the valve open, but the instant the air pressure fails the oil valve automatically closes.

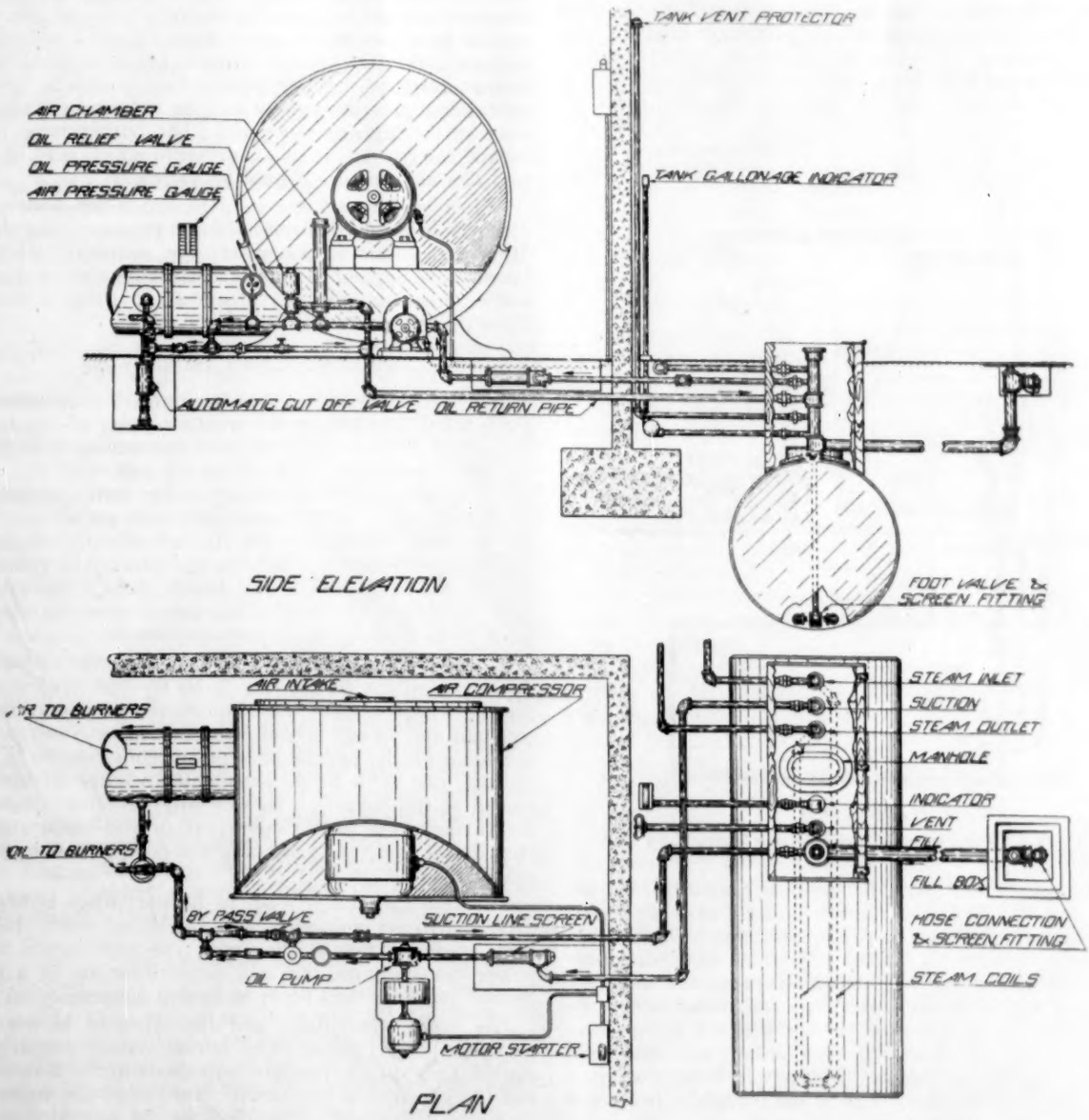


FIG. 3. LAYOUT OF OIL SYSTEM, LOW PRESSURE, USING TURBO, CENTRIFUGAL OR FAN TYPE BLOWER.

BURNERS

Many claims are made for the thousands of oil burners on the market and the savings that can be made by the use of various devices, etc. However, considering that

*This article began in the October issue.

the furnace is properly constructed, when you have secured all the heat that you require with perfect combustion your burner is doing all that can be done, as no burner or device will enable you to get more heat out of the oil than the number of heat units, or B.T.U., which the oil contains.

The oil burner must also be of the proper size and type for the furnace for which it is to be used. A good oil burner can be easily constructed of pipe and pipe fittings by one who knows how, but this burner would be constructed differently in practically every case. Therefore, it is just about as foolish to experiment with different makes of burners to find the one best suited for the work as it would be to experiment with different kinds of electric currents to find one which would drive a certain standard motor built for a standard electric current. The right current, and only the right current, will drive the motor. A burner designed for use with certain pressures of air and oil will give entirely different results when the pressures are varied or changed, and may not operate at all.

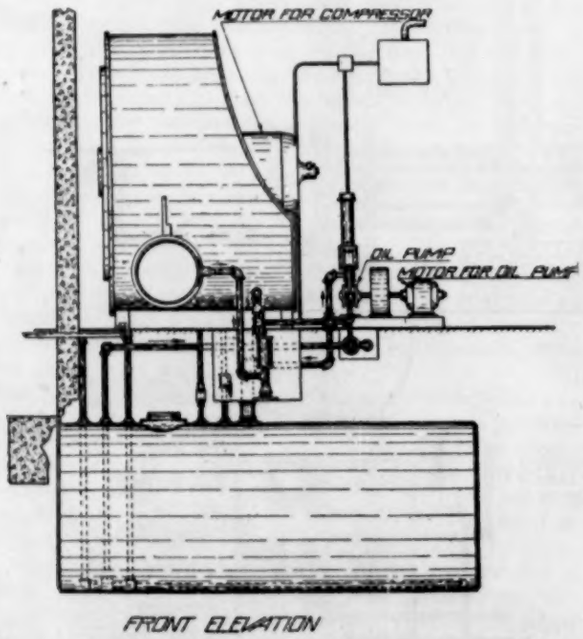


FIG. 4. FRONT ELEVATION OF LAYOUT SHOWN IN FIG 3.

Some people find that sufficient heat cannot be obtained unless the oil is fed to the burner under a very high pressure—ten to eighty pounds per square inch. This trouble, the writer believes, is due to the faulty construction or design of the burner. Such high pressures are only necessary with the mechanical type of burner where no air or steam is used for atomizing, which I do not consider practical for industrial installations, and with high pressure burners applied to large power boilers where a very large quantity of oil must be fed though as few burners as possible. With the properly designed low pressure burner it is necessary to feed the oil to the burner at a pressure of only about five pounds per square inch, sufficient to enable the oil to flow through the burner in a constant and steady stream. A high pressure oil system is, of course, a great deal more troublesome and uneconomical than a low pressure system. In fact, in my opinion it is as foolish to state that high oil pressure is necessary to obtain a high heat as it would be to state that the harder you throw coal in the stove the hotter the fire will be.

A disadvantage with high pressure oil is that the needle valve in the burner must be closed to a very small orifice in order to prevent too much oil from entering the furnace. Small particles of dirt which are not caught by the pipe line strainer easily clog up this small opening. On the other hand, with a low pressure the valve can be opened wider and any particles of dirt passed by the strainer will also pass out through the burner.

There is also a great deal of confusion regarding the pressure of air necessary to atomize fuel oil properly. Some claim that five to eighty pounds pressure are necessary. However, in the majority of installations even the heaviest oils can be burned with perfect combustion using an air pressure of not more than 1½ to 2 pounds per square inch. Of course it must be understood that a burner designed for high pressure air cannot be operated with a low pressure supply and the same results obtained as with the high pressure air. The burner must be designed for the particular air pressure which is to be used, and this air pressure cannot be varied.

When oil burners are used to fire steam boilers, dry steam is often used in place of air for atomizing the oil. It is impractical to use steam for atomizing when the burners are applied to industrial furnaces due to the difficulty of maintaining dry steam at so great a distance from the boilers.

AIR COMPRESSORS AND BLOWERS

It must be remembered in burning oil that volume of air is what is required, the pressure being of less importance. In other words, a definite number of cubic feet of air are required to properly burn a gallon of oil. This air is simply fed to the burner under sufficient pressure to atomize the oil at the buner and inject the oil spray into the furnace. Naturally the size or capacity of the air compressor depends entirely on the number of gallons of oil that are to be burned in a definite time. The style or type of compressor is also dependent upon the class of work to be done, or upon shop conditions.

Where the load on the compressor varies during the day, or from day to day, the turbo type of compressor is the most economical. This compressor delivers air at a constant and steady pressure of one and one-half pounds per square inch; but the horsepower consumed in driving the machine is in proportion to the volume of air consumed at the burners. In this way, when a number of the furnaces are not in operation, or the burners partly shut down, the cost of running the compressor is considerably reduced.

The fan type compressor, or blower, when either belt driven or direct connected with an electric motor, has the same characteristics as the turbo type with regard to the power consumption, but will not deliver air at a much greater pressure than eight to twelve ounces.

The turbo, centrifugal and fan types of blowers are particularly well suited to oil burners, as, if properly designed, they do not produce pulsations in the flow of air and the pressure is constant regardless of the volume of air being consumed. This obviates the necessity of special air receivers and relief valves.

The rotary or positive pressure type of compressor will deliver a large volume of air under a pressure of one to two pounds per square inch, but the horsepower consumed in driving this machine is constant. When the full capacity of this machine is not consumed the excess air must escape through relief or safety valves, and of course air so escaping is a total loss. Therefore, this type of machine should only be used when the demand upon it is constant.

All but the very small size of rotary air compressors should be fitted with a special air receiver which, when properly designed, removes all pulsations from the flow of air. This air receiver is not simply a hollow cylinder.

All rotary or positive pressure types of blowers should be fitted with weighted type, non-vibrating relief valves of sufficient size to vent the entire capacity of the machine. In this way a constant and uniform pressure is automatically obtained at all of the burners whether one or a dozen burners are in operation at the time.

At the present time few of the piston types of air compressors are used for oil burning. These machines are usually operated to produce a pressure of 5 to 125 pounds per square inch, but their capacity in volume of cubic feet of air is comparatively small and the cost of operation for this purpose is excessive. In one installation where a machine of this type had been used for oil burning for a number of years it was found that the cost of the compressed air was as high as the cost of the oil which they were burning—practically fifteen times the cost of using a low pressure machine.

In selecting a compressor, care should be used in selecting one of sufficient capacity to take care of a reasonable growth in the production.

OIL PUMPS

As only about five pounds pressure of oil are necessary for operating industrial furnaces, the small impeller type of pump is best for this service. The smallest standard sizes of these pumps supply 300 to 600 gallons per hour, which is considerably more than the amount usually required. The pump should be fitted with an air chamber, weighted type relief valve, and pressure gage. When the air chamber is properly constructed, all pulsations are removed from the flow of oil. The relief valve is used to carry off the excess of oil which the pump supplies or which results when only a few of the number of burners which it feeds are in use. When this relief valve is properly constructed the pressure of oil at each burner will remain constant whether one or fifty burners are in operation. It is difficult to set a spring type of relief valve at so low a pressure, and as the volume of oil which this valve passes is increased the spring is compressed, which results in the pressure at the burners being increased. Therefore, with a spring type of relief valve, the oil burners must each be regulated whenever one or more burners are shut down. A spring relief valve is also inclined to chatter, resulting in pulsations at the burner.

Of course, when it is necessary to operate the pump at pressures of thirty pounds or more, the triplex plunger type or duplex piston type of pump must be used.

STORAGE TANKS

Too great care cannot be used in the selection of the oil storage tank, or tanks. It is a great deal more difficult to construct an oil-tight tank than to construct a tank simply for the storage of water. It is very difficult, and sometimes impossible, to repair a leading tank, and a great deal of oil may be lost before the leak is discovered. All tanks should be inspected and labeled by the Underwriters' Laboratories of the National Board of Fire Underwriters.

Fuel oil storage tanks should be cylindrical in shape and placed underground so that the top of the shell is at least two feet below ground. These tanks should be of sufficient capacity to allow for a working supply in case deliveries are delayed, and so that tank cars can be entirely emptied as soon as they are received, avoiding demurrage charges. Where shipments are to be received in single carload lots, a 12,000-gallon tank is the smallest size that should be installed. However, many installations embody two or more tanks varying in capacities from 8,000 to 25,000 gallons.

It should be specified that the tank be fitted with all of the pipe flanges and the manhole at one end of the shell on top. In this way it is possible to build a box with a trap door over one end of the tank whereby all pipe connections and the manhole may be easily gotten at.

It is good practice to fit a fuel oil tank with the following flanges and manhole: one 10-in. x 16-in. manhole, one 3½-in. suction flange, one 4-in. fill flange, one 1½-in. vent flange, one 1½-in. return pipe flange and one ½-in. indicator flange.

Every fuel oil tank should be constructed with internal steam coils of proper design. Although it might be possible to obtain a light oil at the time the tank is installed, it may become necessary at any time to burn a heavy oil, which would require heating.

TANK GALLONAGE INDICATORS

Each storage tank should be fitted with a tank gallonage indicator. These indicators show at a glance the contents of the tank. They may be placed inside of the nearest building, outside of the building against the wall, directly over the tank, or on the side of above ground tanks.

INSTALLATION OF OIL BURNING SYSTEMS

The proper installation of an oil burning system is of as great importance as the selection and construction of the necessary equipment.

In order to avoid fire danger, secure the lowest insurance rates, and obtain the largest possible degree of efficiency, this problem should be handled from an engineering standpoint and definite scientific principles applied.

Oil Pipe.—The proper size of suction and discharge pipe should be calculated so as to decrease as much as possible the loss of pressure due to friction in the pipes. Elbows should be avoided wherever possible. Foot valves should be installed at the end of the suction line so as to avoid the necessity of priming the pump. A pipe line strainer in duplicate should always be installed in the suction line.

Fire arresters should be installed in the suction, discharge and return pipe lines. These will avoid any danger of the storage tank being blown up should the plant burn down.

Only the best grade of pipe, fittings and valves should be used.

Air Pipe.—The proper sizes of air pipe should also be given very careful consideration and scientifically figured. It is advisable to draw clean, fresh air from out of doors if possible. The air pipe should never be smaller than the connections on the compressor or blower; and when the air is to be carried some distance this pipe should often be much larger, being reduced right at the air compressor connections.

In large low pressure installations, where exceptionally large air pipe is required, spiral riveted or welded sheet steel pipe is more economical than wrought iron pipe and is as satisfactory. Elbows and sharp bends should be avoided as much as possible. This is especially true where centrifugal, turbo or fan types of compressors are used. Gate type valves, or cocks, should be used.

It is advisable to install a valve or cock, a union and a swing check valve in the branch lines to each oil burner, so that any burner may be disconnected without shutting down the entire system. The check valve acts as a fire arrester.

Pipe Joints.—All oil pipe joints should be carefully cut and threaded and made up with a mixture of litharge and glycerine, which should be applied to the male end of the connection. Red lead, or white lead, should never

be used. The air pipe, however, can be fitted with red or white lead. Each leak in an air line might be small, but a number of such leaks greatly reduces the volume of air available.

All oil and air pipe should be installed to allow for the addition of a reasonable increase in the number of oil burners or furnaces.

Fill Pipe.—When the storage tank is to be filled from barrels or tank wagons, a two-inch water-tight fill box can be installed directly over the tank. This fill pipe can also be used for dropping a gage stick into the tank. However, whenever the tank is to be filled from tank cars by gravity, a three or four inch pipe line should be run from the tank to as close to the railroad siding as possible. The end of this line should be fitted with a pipe line strainer, a hose connection nipple with cap and chain, and a cast iron lock cover box. A ten-foot length of three-inch metallic hose should be used for connecting the tank car with the fill pipe.

A tank car connection fitting should be used for connecting the hose with the tank car connection.

If the storage tanks are placed above ground and above the tank cars, a power pump must be used for unloading purposes. This pump should have a capacity of at least 100 gallons per minute.

All tanks should be connected with a vent line running from the tank to above the roof of the nearest building, and should be capped with a weatherproof vent protector fitted with fire screens. On tanks below 1,000 gallons capacity a one inch vent line is sufficient. Larger tanks should be fitted with a 1½" vent line.

A ½-inch pipe line is sufficient for the tank gallonage indicator.

All storage tanks should be placed horizontally underground so that the top of the shell is not less than two feet below ground. However, the tank should not be placed too far underground or the suction lift from the bottom of the tank will be too great. The bottom of the tank should be not more than 14 feet below the pump level.

Where the bed rock is near the surface of the ground the tank should be anchored to this bed rock by means of straps over the top of the tank. Also, when the tank is installed in wet ground it should be placed on a concrete foundation and anchored to this foundation. If this is not done in either of the above cases the tank will work out of the ground of its own accord and break all pipe connections.

Storage tanks should not be installed in vaults. Oil gas is heavier than air and so these vaults become filled with a poisonous and explosive gas.

Never enter a used oil tank through the manhole or attempt to make any repairs on it until it has been thoroughly steamed out; or better still, flooded with water and emptied.

HEATING OILS

Many heavy oils which make excellent fuels cannot be burned or pumped unless they are heated to a temperature of approximately 120 degrees in order to reduce their viscosity. As stated above, all fuel oil tanks should be fitted with steam coils. When heavy oils are to be burned, all oil pipe lines should also be closely paralleled with steam lines. These steam lines should be run as close as possible to the burner connections. The steam and oil pipes should either be wrapped together or run together through a soil pipe to avoid loss of heat.

Special oil heaters only heat the oil at a certain point and are only advisable when the rate of flow is comparatively high. As the rate of flow is usually very slow it will be seen that a great deal of heat is lost when long runs are necessary after the oil leaves the heater and before it reaches the burners. On the other hand, by paralleling the oil pipes with steam lines the oil is kept constantly hot from the storage tank to the burners. In some cases, the oil pipe can be steam jacketed by enclosing it in a large steam pipe, but great care should be taken not to heat the oil above the vaporizing point.

When heavy oils are used the system should be drained whenever the plant is shut down to avoid the solidifying of the oil in the pipes and difficulty in starting up the system.

Nickel on Babbitt

The nickel plating of a lead based babbitt metal is not a difficult proposition. Care must be used in cleansing the metal so that it does not become dark. Usually a solution composed as follows is effective:

Water	1 gallon
Caustic Soda	6 ozs.
Sodium Cyanide	½ oz.

Temp. 180° Fahr.

Excessive buff or polishing material should be removed by cleansing with gasoline or benzine and afterwards dry out in maple sawdust. Cleanse in the alkali solution, wash thoroughly in cold water and nickel plate direct.

NICKEL SOLUTION

Water	1	gallon
Single Nickel Salts	14	ozs.
Boracic Acid	1½	"
Sal Ammoniac 98 per cent	2	"
Epsom Salts	1	oz.

Voltage 3, Normal Temperature, 10 to 15 Amperes per square foot of surface.

The Nickel solution should be prepared by dissolving the nickel salts and boracic acid in one third the water nearly boiling. Then add the two thirds cold water and finally the sal ammoniac and epsom salts. Anodes of cast nickel should be used.

Many platers, however, prefer to coat the babbitt metal with a preliminary coating of copper in the combination cleaning and copper plating solution previous to nickel plating. For this purpose an iron tank should be used. The positive current is connected to the tank direct. On each side of the tank should be attached one or two copper anodes. A strong current is used. The solution is composed as follows:

Part No. 1.

Water	1 gallon
Caustic Soda 76 per cent	3 ozs.
Soda Ash 58 per cent	3 "

Part No. 2.

Sodium Cyanide	1¼ ozs.
Copper Cyanide	1 oz.

The solution should be prepared by dissolving the sodium salts in ⅞ of the water hot, the sodium and copper cyanide in the balance of the water. Then mix. The sodium cyanide should always be dissolved in the hot water first, then the copper cyanide. The solution is run at a temperature of 180° Fahr. at 4 to 6 volts.

A deposit of copper is produced in a few seconds.

Replenish the solution with a concentrated solution of sodium and copper cyanide when required, to keep up the deposit of copper, adding only small proportions at a time.

Caustic soda should be added occasionally to keep up the cleansing properties of the solution. C. H. P.

Pattern Shop Casualties

Some Suggestions For Their Prevention, and a Few Friendly Warnings.

Written for The Metal Industry by WILLIAM H. PARRY

It has been a long standing saying among wood patternmakers that a man is never a patternmaker until he can show at least one finger missing from either hand, due to avoidable accidents while operating high speed wood working machinery, such as circular saws, jointers, band saws, and not infrequently lathes. In the old days when State Factory Inspectors were unknown and devices for the protection of operators of these machines were conspicuous by their absence, many frightfully mangled hands and faces were in evidence, and even in these days when laws have been passed, but not always enforced, there are altogether too many casualties connected with the patternmaking trade, not because of legislation seeking to protect the operators, but very often by reason of the devices themselves not being practical, though approved by the various state factory bureaus.

CIRCULAR SAWS

It is a much mooted question which of the two machines, the circular saw or jointer is the more dangerous to operate, as they both rank high as mutilators and number their victims by the thousand. It is a safe bet that at least ninety-five out of every hundred accidents are the result of somebody's carelessness, and I mean by this, that it is not always the operator's fault, as there are many cases of contributory negligence either on the part of a fellow workman or the man in charge of the shop; and if accidents are to be cut down it means that everybody connected with the trade will have to watch his step in contributing to its general welfare. A circular saw when not in motion is all but harmless, but once in motion becomes a terrible instrument of destruction to anything forcing its way through its sphere of action.

Strange as it may seem, it is more dangerous when its dull teeth are being forced to do work for which they are not fitted, than when the teeth are sharp and well set. To force stock against a dull saw with no "set" to its teeth is as much of a crime as voting for Prohibition.

In sharpening a circular saw see to it that every tooth is sharp and does its work, not each alternate one, or every fifth one, as is so often the case. See that the "set" is even on both sides, and is not allowed to wear away.

Don't confine yourself to owning but one crosscut and one rip saw; have at least one spare of each, and always sharp. See that the fence or guide is at least parallel to the fence side of the saw. This feature is very important, as the worst possible condition is for the fence to be out of alignment so badly as to choke the stock and cause "kick backs," very often with disastrous results.

See that the table is kept free from surplus stock, probably left there by the previous operator.

To operators I should say "don't monkey with a buzz saw," which is another name for what I have been writing about for the last half hour or so. Don't attempt to handle any of the stock at the back of the saw, either while it's going through or after. To abide by this rule is imperative, as many fingers, yes, and hands, have been lost by the operator from his position in front of the saw seizing the two ends of a partly severed piece, thus closing the kerf and clamping the sides of the saw, which contact shoots the piece back like a bullet, and, needless to say, the hand and fingers with it, directly on the saw's teeth. I repeat, don't attempt to handle any stock at the back of the saw from your position in front of it.

I have not seen a circular saw guard yet that is worth room in Hades. Most of them invite accidents, and the best of them are to be avoided.

Probably the guard that is not in any way connected with the saw table is the most practical of a bad lot, in that it at least leaves the table clear by reason of its suspension from ceiling or adjoining post.

Before saying goodby to the operators of buzz saws, it may be well to mention that in sawing stock of any thickness below the height that the saw projects through the table, it is always good practice to bring the saw height down, so that it just cuts through, and no more. Don't attempt to crosscut stock from the end of a 12, 14 or 16 foot plank by attempting to handle the outboard end unassisted. I have witnessed some fine calisthenics result from this abuse of a circular saw's feelings. Sometime in pushing a plank through the saw the stock will "close in," due to the curling proclivities of that particular piece (which, by the way, is ever present in some stock, even if air dried for a thousand years). Either step aside, or, if you have end enough projecting in front of the saw, tilt the stock off the table using the front edge as the fulcrum.

JOINTERS

Now as to jointers, there is a lot to write about, as this machine should have the post of honor in "Murderers' Row" by reason of its long record as a destroyer of hands and fingers. Here again the same rule applies as to woodworking machinery which is, that dull cutting edges are far more dangerous to the operator than sharp. When the knives are dull and nicked the operator has to use much more force to pass the stock over, unmindful of the fact that dull knives are balky and cannot perform their functions, and, as the operator persists in forcing them to do the impossible, the stock is often shot back, and one, and sometimes both, hands come in contact with the cutter bar knives with awful results. Particularly so in the old days when the square cutter bar was in use (there are lots of them in use today). This meant that the gap between the two tables and knives was wide enough for a hand to drop in, and when this happened that patternmaker went through life an awful cripple because of the negligence of the party responsible for the proper care of the machines. As the jointer is a wonderful labor saving machine in the pattern shop, it follows that those in charge of shops where they are used should be made to understand that they are much more efficient when kept in order and that no patternmaker be allowed to use them unless they are so kept. Any shop owner who is either too careless or too mean to allow the use of a square cutter bar as part of these machines ought to be jailed for life, yes, even if he keeps the knives sharp, as there is no excuse in these days when round cutter bars can be obtained for any make of machine by the expenditure of a reasonable sum.

Let us assume then that the round cutter bar is in use, and on that as a basis lay down a few rules that many years of experience have taught us to get the best results out of this machine, and how to avoid accidents while using them.

It must be understood that the machine, though equipped with round cutter bars, can be made a fine instrument of torture if not properly manipulated. The foremost rule in a pattern shop, and it ought to be prominently displayed on a signboard in close proximity to the

jointer, is that any operator who leaves the feed table in the position that suited his particular requirements without bringing it back to the negative postion be instantly discharged, as this very neglect on his part is the direct cause of many wounds. The succeeding operator assumes that the platen is in that position and adds to the feed so much as to endanger his hands, especially when taking a wide cut, say to the limits of the table width.

Of course the operator who assumes that the rear table has been left "safe" is to blame somewhat, as any careful mechanic will first test the table before pushing his stock along its surface, but all mechanics are not careful. In a recent accident in a shipyard pattern shop in Brooklyn, a young patternmaker rushed over to the jointer to remove the surplus stock from a wedge-shaped piece by dropping same on top of the knives, a very dangerous practice in itself, and more so in this instance, as the preceding operator had left the table position just as he had used it. The result was the loss of three fingers and the mangling of a fourth on the left hand. He may in the future tell his offspring how many pieces of shrapnel he stopped with his left hand while battling sixty-five "Heinies" with his right, but as he is a patternmaker I hardly think he will get away with it.

A mistake made very frequently by shop owners is installing jointers on the principle that if one six inches wide is a good machine, one twenty-four inches wide is better. This is utterly fallacious, as they very soon find out, as the average width of stock pushed over a jointer rarely exceeds ten inches, and a sixteen-inch jointer is plenty wide enough for the average pattern shop, and is much safer for the operator. He does not have to lean over the table to find a sharp spot on the knives and in so doing lose control of himself. The little bench jointers that handle stock up to six inches in width are time savers, and as they all use round cutter bars the danger is at least confined to six inches. There are other makes on the market that are arranged to plane draft on stock to the limits of the table width, but my advice is to let them severely alone, as they are more dangerous than the ordinary make and the increased price is not justified.

The manipulation of the fence or guide on jointers deserves mention, as they are usually used while edging stock, and if the stock is wider than the fence is high it is a fairly safe operation, but if the stock is thin and less in width than the guide there is danger of the piece tipping over and bringing the hand with it, the more so if a heavy cut is attempted, as it is far safer to remove the stock by a succession of cuts as against one heavy one. Rubber matting securely fastened to the floor in the path of the operator is a sure means of preventing the feet slipping when operating the jointer, though to be candid the worst that ever happened to me due to a slippery floor was the total destruction of two aprons by getting them fouled in the outboard end of the cutter bar. Yet the consequences could have been serious. The protecting guards used on these machines are not only useless, but are actually dangerous and always in the way. Possibly the best of them is the telescopic affair that can be used to prevent the operator from resting his left hand on the knives while pushing the stock over with his right.

My advice to patternmakers in general is that when operating any woodworking machinery to keep their eyes and wits on the job no matter who may be passing in the vicinity of the machine, be it the boss or the boss' boss, as many accidents happen because the operator's eyes and wits rove momentarily from the task at hand.

Again, we have always with us that abominable nuisance who will try to engage the operator in conversation, when as a matter of fact he is having all he can do to operate the machine properly. A man operating dangerous machinery has no time to talk or listen to talk.

BAND SAWS

The band sawing machine is not usually classed among the dangerous types, but as I have witnessed some very serious accidents due to no fault of the operators, I will class it among the dangerous. Most band sawing machines as made today are provided with guards covering both wheels, and so far so good; many of them are also equipped with vertical guards parallel to the blade's path, and if made long enough and shaped properly do prevent many accidents, but the worst of all casualties that I ever witnessed was occasioned by an improperly shaped vertical guard, which was placed there to prevent the blade from being thrown outward when broken while running.

Strange as it may seem, the operator was not hurt in any way when the saw broke, but a boy who was approaching the machine, and fully eight feet away, was struck by an end of the blade, which entered the left temple for a distance of two inches, proving that there was a great danger ever present even when the machine was in good health. An examination of the machine showed that the designer was at fault, because attached to the outboard vertical guard was a block of wood which just cleared the saw blade, the top of which was shaped like an inverted V so made as to shed the sawdust which will collect on horizontal surfaces but which proved to be the medium that deflected the broken saw blade end and converted it into an instrument of destruction, in this instance almost certain death.

There is not much use in sprinkling advice as to how band sawing machines can be made foolproof if designers will persist in practices that prove that mechanical engineers are not entirely removed from the fool class. For instance, I have operated a band saw with the upper wheel hub so designed that when the blade broke it resolved itself into a committee of one and was the "whole works" as a winding spool. Woe to the poor patternmaker unfortunate enough to be in the neighborhood of that machine previous to a change made not only to the hub in question but the wheel guard that was so designed that it actually enticed the busy end of a broken blade to flirt with the wheel hub.

The best advice I can offer does not include guards right or guards left, but does include the care of the saw blades and the machine.

1. Assuming that your band sawing machine has 36-inch wheels, the R. P. M. must not exceed 500 or be less than 400.

2. See that the bearings are kept well oiled always and are not allowed to wear so badly that any play is present.

3. The rubber bands on the wheels must be kept so that no ruts form thereon, thus preventing longitudinal weakness of the blade already afflicted with latitudinal spinal meningitis, or something allied to it, because of the constant changing in shape from the semi-circular to a straight line at the rate of several hundred times a minute.

4. In putting on a saw blade don't tighten the blade to the limits of your strength as the strain on the blade will be too great and it will not do as good work as when tightened just enough to take the kinks out of it.

5. After a blade has been broken in service three times it's about ready for the scrap heap, the breakages after the third separation being too numerous for comfort and always to be regarded as dangerous.

6. Don't attempt to force a saw blade to do more than it is capable of, as spoiled work and disaster result from this practice.

LATHES

Lathes as producers of contusions and an occasional black eye are to be treated with respect by the pattern shop fraternity. Strange as it may seem, they do sometimes kick over the traces, not because of their innate wickedness, but because those who attempt to turn halved pieces improperly fastened to at least resemble a whole unit will sometimes get in the way of one of the halves on its way across the shop, thus proving that a solid block of wood can be stopped by a solid block of "ivory" at times. How often do we witness the rusher who will not wait until the glue dries sufficiently on a course of segments trying his sprinting abilities while ducking out of the way of a whole flock of the curved pieces which have been flung off by the centrifugal force ever present in rotating bodies.

Again, we have looked with sorrow upon the alleged lathe hand who, to remove the rough stock quickly, resorts to the use of an outside gouge, commonly used in carving only, with the result that either the gouge or the generous chunks that it has removed hits him a biff on either the port or starboard glim and puts him in line for compensation insurance to which he is not entitled.

It is not an easy task to lay down rules for the guidance of patternmakers who occasionally operate lathes, as the range of work varies so very much both in kind and diameter. That judgment to fit the job is more valuable than all the rules in creation is true, yet it is well to remember that halved work when rotated speedily is not to be trifled with and means for fastening the halves to each other must not be neglected. Even if one has to resort to dogs, screws and glue on the one job, better be sure than to go through life with a defective eye or a nose pointing southwest. In segment work particularly when on a hurried job there is a tendency to forget to nail or fasten the courses to one another, if the work at hand will permit it, with the result that the pieces fly off and strike the operator or anybody in range. A little patience and common sense coupled with the knowledge that glue does not dry quickly in damp weather has saved many an eye and face from disfigurement.

Again, a study of safe speed by the young patternmaker at least is a fair guarantee of future immunity from lathe accidents, though I sometimes think that safe lathe speeds had best be learned by experience. For instance, when one of the ilk without looking at the cone belt position and wholly indifferent to the fact that his predecessor had been turning one-inch core prints, throws over the shipper handle only to find that while his job is seven or seventeen times the diameter of the previous one, the factor of safety has been reduced in inverse ratio, and if he is brave enough to shut off the lathe without being hurt it ought to teach him to look over the cone belt position in the future if he values his complexion.

Finishing Lighting Fixtures

Some New Methods Which Have Worked in Actual Practice.

Written for The Metal Industry by FRED. G. LEAL, Foreman Plater, Moran & Hastings Manufacturing Company, Chicago, Ill.

BRUSH BRASS

Brush brass is still in great demand everywhere on account of its semi-lustre and wearing qualities. The customary way of producing the finish is to use a brass wire wheel and wet sand applied to it. Much time can be saved by using a steel crimped wire wheel, gauge about one seven thousandth thick, with about the same speed as for wet brushing. Occasionally rub a little lump pumice stone across the wheel to keep it clean, also to help bring out the dull finish. Better results are obtained by going over the object with a dry brass wire wheel.

Tubing brush brass is finished with a cheap and simple arrangement consisting of a straight shank screwed into the spindle of a polishing lathe, to fit the inside of the tubing about six inches in length. If the tubes are over five feet long, the end farthest from the spindle should be held loosely with a similar shank fastened to a stout plank which is hinged to the floor, and a coil spring to draw the plank toward the lathe. A coarse wet sand or pumice on a rag is pressed against the tube, at the same time drawing the sand rag from one end to the other. Then go over the tube with a wet sponge, remove the tube from the lathe, wipe dry with tissue and lacquer. I have finished 30,000 pieces of 6-ft. tubing in this manner.

ANTIQUE SILVER

This is still in vogue. The rich brown shade produced by a liver of sulphur stain used hot can be closely imitated with water proof inks and an air brush outfit. The high lines are relieved with alcohol or can be brushed down. Only a light deposit of silver is required, and besides the natural tone or shade of silver which is so desirable is retained.

SPRAY FINISH OF ADAM GILT OR GOLD AND GREEN

Polish smooth rough castings, etc. Clean the articles and prime with lacquer. Spray a satin gold bronze. After drying cut the high lines with No. 150 emery. Polishing wheels, buff same with half-sewed sheepskin wheels, then fill in details with a water color green of a soft shade. Finally spray all over with lacquer slightly gold colored.

SPRAY FINISH OF FRENCH GRAY SILVER

Treat articles as for Adam Gilt and spray a suitable mixture of gray bronze. After drying cut high lines with a very mild cleaner. Then strike in a bright nickel solution. Wipe dry and lacquer with transparent lacquer.

WELDING MONEL METAL

The secret of success in welding monel metal parts and castings is the pre-heating and the cooling methods after the weld is made and before proceeding with the weld.

The analysis of monel metal shows a large nickel content and as everyone with any experience knows a pure nickel casting must be preheated. On account of the two most important metals used in the manufacture of monel metal, copper and nickel, it is easily understood that they must be brought to a pre-heating temperature of about 1,500 Fahr. before the weld is attempted. After the casting is welded it should then be brought again to approximately 1500° F. and placed in hydrated lime in order to prevent any air getting at it.

When the casting is allowed to cool slowly with hydrated lime, it will not crack, and a perfect weld will be the outcome. The average person that has endeavored to weld monel metal, will state that after the weld was accomplished it was O. K., but when it had cooled off it was all cracked.

By following the method outlined of preheating and cooling the castings slowly no cracking will occur.

P. W. B.

Hardness of Certain Aluminum Alloys

Conclusion. A Translation of the Investigations of W. Fraenkel and R. Seng in Zeitschrift fur Metallkunde, July, 1920.*

Written for The Metal Industry by R. E. SEARCH, Metallurgist

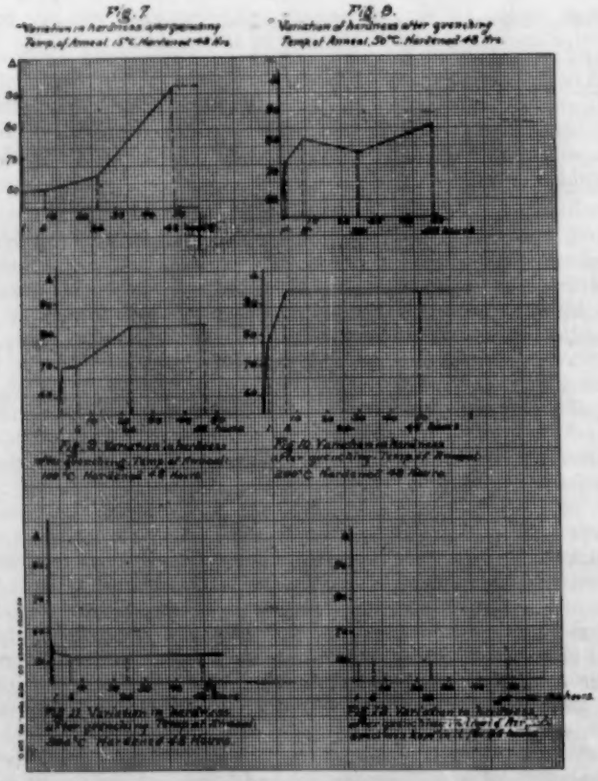
Nevertheless one point is to be retained: the rapidity of attack by the reagents is much greater for the products quenched at 475 C. and dropping back to 300 C. as well as for the temper hardened ones as for the quenched products.

STUDIES OF THE TEMPERING AFTER QUENCHING

The quenched specimens have been submitted to annealing at different temperatures (the annealing is done at 150 C. in the air, 100 and 300 C. in a bath of salt), and followed by the ball tests, their variations in hardness are expressed in functions of the temperatures to which they were submitted. The results are condensed in the following table:

Temperature of Anneal After Quenching.	Hardness after a period of annealing of—				
	0	1 hr.	6 hrs.	24 hrs.	48 hrs.
15 C.	61	61	61	65	93
50	61	73	80	77	86
100	57	70	71	83	83
300	61	54	53	53	53
200	57	77	93	93	93

These results are shown graphically in Figures 7, 8, 9, 10 and 11.



CHART—FIGS. 7-12. EFFECT OF HEATING AFTER QUENCHING

This phenomena is logically explained if it be admitted that the quenching at a temperature comprised between the limits of 400 and 450 C. has in effect to maintain at least partially the stable state at white heat, but that it is produced at the very beginning of the ordinary temperature to a partial come back by annealing in the stable, cold state; this return is the more rapid the more elevated the reheating temperature is, at least within certain limits (at temperatures below 300 C.), the best temperature appearing to be 200 C. and not 150 C., as indicated by Wilm.

If this point of view is correct, the maintenance of the quenched metal at very low temperatures should prevent this return to stability when cold; this view is confirmed by the results of the authors' tests of quenching in liquid air, in maintaining in this way the quenched metal, as indicated by the curve (Fig. 12) and the following table; in these conditions the effect of tempering is not obvious.

Before Quenching Metal Annealed.	Hardness Immediately After Quenching.	After 24 hrs.	After 48 hrs.	After 72 hrs.	After 96 hrs.
65	61	61	61	61	61

It is necessary to note in addition that after this continuance in liquid air the metal has not lost its aptitude for tempering, the specimen, taken out again from the liquid air after 96 hours and abandoned to the air at 15 C., passes successively to the following states of hardness:

After 1 hour at 15 C.....	61
After 6 hours	61
After 24 hours.....	63
After 48 hours.....	93

After further examination, both of this work and that of the recent work of American physicists, the conclusions which are drawn from these tests and through the mechanism of quenching of steel and of duralumin establish a certain parallel. The work of Merica, Karr, Waltenberg, Scott and Freeman of the Bureau of Standards of Washington, D. C., are referred to at length in Part III, but as representative abstracts of this work have already been published in THE METAL INDUSTRY, it is not necessary to repeat them here.

THE MOST IMPORTANT PHENOMENA

The insufficiency of the verification of the facts known about these alloys led the investigators to announce the following conclusions:

1. Aluminum alloys show the phenomena of being strengthened by aging only, or in any case only, in a pronounced manner, when they contain another metal in addition to magnesium. Until now detailed investigations, to be sure, have been carried out only in Aluminum-Copper, or Aluminum-Zinc alloys with additions of Magnesium. (This statement does not fully cover the case but is excusable perhaps because the authors were not familiar with the work done by the American observers, Merica, Waltenberg, Finn, Scott, Karr and others, see THE METAL INDUSTRY, January, 1920, pp. 16, 17 and their continuation in the February issue.)

It cannot be disputed that in the place of copper or zinc other metals cannot be substituted, and also that magnesium is unreplaceable by any other component. Most of these investigations have been carried out with alloys containing copper, but some zinc alloys have also been studied.

2. The effect is produced by heating up to a certain

*Part I of this article was published in THE METAL INDUSTRY, September, 1920, p. 403.

point required by the other constituents to an alternating temperature at which the alloy must be quenched. After this when quenching is followed by aging there appears to be the strengthening desired.

3. The strengthening alloys lose their strength when they are heated above a certain temperature, depending likewise upon the other constituent parts of the alloy. This temperature is lower than the quenching temperature. This may be explained from a negative point of view by saying that if the aging takes place above this temperature there is no strengthening.

4. The alloys which by heating above the temperature limit stated under 3, have lost their strength; they become strengthened when brought back to room temperature, but if heated up to the second temperature stated, followed by quenching their strength no longer returns to the normal state.

5. If the alloy is slowly cooled from the temperature referred to under 2, then no strengthening takes place.

6. The rapidity of the action of strengthening runs along with the temperature in which it chiefly occurs, depending on the temperature range and indeed is greater the higher the temperature (confirmed by Dr. Zay Jeffries' conclusions) and at the temperature of liquid air this strengthening is imperceptibly small.

7. Immediately after the quenching the alloy shows the mechanical properties which it exhibits when it has lost its strength by moderate heating.

THE MECHANICAL PROPERTIES

These investigations were undertaken on a broader foundation. Most of them were carried out with an alloy containing 3% copper and 8% zinc, and always with ½% of magnesium added. There was also an alloy with 1½% of copper and one with 4% zinc, but limited in quantity, both contained only ½% of magnesium, also one with 8% zinc and 0.1% magnesium and finally one that contained no magnesium.

The following alloys were used in this investigation:

MARK	COMPOSITION
67 a	8% Zn. 0.1% Mg.
87	4% Zn. 0.5% Mg.
88	1.5% Cu. 0.5% Mg.
89	0.5% Mg.
90	8% Zn.
T	8% Zn. 0.5% Mg.
D. A.	3% Cu. 0.5% Mg.

The alloys were cast from standard metals in the proportions stated above, melted together and run into plates. The plates were first rolled hot, then cold into sheets of 2 millimeters thick. The cold rolled plates were taken as the basis of this investigation.

First of all there was established the temperatures to which the alloys were to be heated to attain strength, should go to T-1 and the temperature T-2 above which they must not go without danger of losing the strength already acquired.

The establishment of T-1 happened by itself (Note: T-1 and T-2, each represent different groups of temperatures and not any one particular temperature as might be inferred at times from the confused wording of the text. R. E. S.). The tension test plate (a flat sheet test plate 18.5 centimeters in length over all, 3.2 centimeters wide at the ends, 1.5 centimeters wide across the reduced section, 7.5 centimeters in length from fillet to fillet at their starting points, and 2 millimeters thick) was heated in an electric furnace—that was wound with asbestos wrapped nickel wire—for about one hour up to a certain temperature, quenched in water and allowed to stand for at least four days at room temperature in a small testing machine before pulling.

These results were compared with other test pieces that had been heated up to T-2 and again annealed. The temperatures applied were taken with a thermo-couple of iron-constantan. The temperature constancy of the furnace and the readings of the thermo-couple did not vary more than 10° C. It is shown, what also could be derived from the information disclosed by the patent about Duralumin that no temperature limit exists under the most favorable circumstances, at which the alloy could reach its maximum strength. From this circumstance it became necessary to establish the temperature to which the alloy must be heated in order to be strengthened after quenching and aging. These temperatures for the various alloys at various degrees were found as shown in tables 1 to 4; from which it is perceived that the strengthening is reached at various quenching temperatures. The tables are provisional in order to point out the results that are the most important, condensed, simplified and rounded off. Small deviations are not surprising since smaller experimental melts are often not attended with equal success. Only tests which had a minimum elongation of 10% were considered. The first four tables and the second four are condensed respectively into one table each.

TABLES 1 TO 4 INCLUSIVE. HEATING TIME ONE HOUR.

Table No.	Temperatures °C.	Uutimate Strength in Kg. Per Sq. Millimeter.	Alloy No.	Remarks.
1	550	39	D.A.	Full strength.
3	520	29.2	88	Full strength.
1	500	36	D.A.	Full strength.
3	460	32.7	D.A.	
3	430	22	88	Clearly begins.
1	410	25.7	D.A.	
1	400	23	D. A.	Clearly begins.
2	400	30.5	T	Full strength.
4	400	27	87	Full strength.
3	400	17	88	
1	380	18.3	D.A.	
3	380	16	88	
1	370	18.5	D.A.	
1	340	17.6	D.A.	
2	300	26	T	
4	300	19	87	Clearly.
4	280	14	87	
4	260	16	87	
2	250	26.5	T	Clearly begins.
2	230	19	T	
2	210	18	T	
2	200	19.4	T	
1	..	17.6	D.A.	Unstrengthened.
2	..	16 to 19	T	Unstrengthened.
3	..	15	88	Unstrengthened.
4	..	16	87	

TABLES 5 TO 8 INCLUSIVE. METHOD A.

Table No.	Temp. °C.	Time, Hours.	Ultimate Strength in Kg. Per Sq. Mm.	Alloy No.	Remarks.
6	100	30	21.5	T	Previously 26.5 Kg.
6	100-110	70	22	T	Previously 26.5 Kg.
6	100-110	140	24.1	T	Previously 26.5 Kg.
8	120	6	18	87	Previously 27 Kg.
6	130	1	24.8	T	
6	150-160	24	22.7	T	
8	150-160	6	16	87	
8	200	2	15	87	
6	200	2	21	T	
6	200	16	18	T	
5	200-210	24	36	D.A.	
5	225	15	34.1	D.A.	
5	225	27	33	D.A.	
5	225	34	29.2	D.A.	
5	240	5	33.5	D.A.	
5	240	7	33.6	D.A.	
5	240	24	29.1	D.A.	

6	240	24	16	T	
5	250	1½	34.7	D.A.	
5	250	3	28.6	D.A.	
5	280	2	25	D.A.	
7	280	2	31	88	Not completely altered.
5	300	3½	20.9	D.A.	
7	310	2	26	88	
7	340	2	21	88	
5	370	4	19.3	D.A.	

The alloys free from magnesium showed no increase in strength.

The temperature T-2 was determined according to two different methods. Once for all one proceeded from the strong specimen and heated it for a shorter or longer time at the given temperature and ascertained the difference of the tensile values between the heated and the unheated specimens. This method is indicated in the Tables as "Method A."

It was foreseen that one must reach the same result when a freshly quenched specimen is not strengthened at room temperature, but soon after quenching is placed in a furnace regulated to constant temperature and then held for a longer time at a temperature as constant as possible. Up to temperature T-2 then, a strengthening must take place; at a higher temperature the strengthening must cease. (Method B.) The results obtained are given in Tables 6 to 10. All in tables 1 to 4 are said to be true for these values.

As one may see, T-2 has no constant fixed temperature. All that one can say is that with "Method A" the values begin to diminish from a certain temperature. With these results the time of heating is of importance as especially seen in Table 5. With 15 hours heating the alloy D. A. at 225° C. for example there was scarcely any increase of strength; at 34 hours, the retrogression was essentially great. Especially is it to be remarked that at 225° C. where the value begins to recede, in the investigation according to "Method B," a strengthening still appears. The same result could be attained with alloy-T. Allowing the specimen to age at 100° C. still led to a strengthening (Table 10) while with the strengthened test piece at 100° C. after a longer time, a retrogression of the tensile strength takes place (Table 6). To be sure, it appears as if the strengthening only receded somewhat and after that its tensile strength remained constant. In addition if these experiments are to be completed they must be carried out over a long continued interval of time, accompanied by heating at lower temperatures. In any case it is evident that for the results obtained copper alloys require a higher temperature than zinc alloys. For example, while the D. A. alloy after 24 hours heating up to 200° to 210° C. shows scarcely any loss of strength, but the deterioration of the mechanical properties of the T-alloy after 24 hours at 150° to 160° C. is already noticeable; after only 2 hours at 200° C. it is further depreciated. It is remarkable that the alloy 88 which differs from alloy D. A. by only a small quantity of copper, after two hours of heating at 280° still shows no loss of its properties, while with D. A. after the same method of treatment a very noticeable retrogression sets in.

Tables 9 and 10 contain the results which were obtained according to "Method B." These experiments, first of all, were carried out with the D. A.- and T-alloys. They led naturally to similar results; at 170°-190° C. they gave for the alloy D. A. an extraordinary high value for the tensile strength; likewise at 220° C., while at 250° C. an increase of strength no longer appears. A comparison of these figures with that of Table 5 confirms the statements of Dr. Zay Jeffries and others, that at these higher temperatures especially, a greater strength is obtained, but which, with longer heating shows a retrogression in strength. The application of the "B method" to zinc alloys confirms again the statement that with these the temperature T-2 is lower.

Many tests of cast test pieces, in spite of the corresponding composition and treatment showed chiefly no additional hardness with the lapse of time. Such phenomena also American observers have recorded (Chem. and Met. Eng'r, V. 21, No. 11, 1919). See also abstracts of the vast amount of work done on Light Aluminum Alloys, including Duralumin, by American physicists and metallurgists published in THE METAL INDUSTRY January and February, 1920.

It could also be demonstrated that frequently the air exerted an influence on the tests, which, after quenching, was retained, and after the air was excluded showed a normal strengthening.

TABLES 9 TO 10 INCLUSIVE, "METHOD B."

Table No.	Increase at Temperature.	Time, Hours.	Ultimate Strength in Kg. Per Sq. Mm.	Alloy No.
10	100-110° C	24	28.8	T
10	160-170	24	22.4	T
9	170-190	24	44 (!)	D. A.
10	200	24	19.4	T
10	210	24	17	T
9	210-230	24	38	D. A.
9	220	16	43	D. A.
9	230-240	20	38	D. A.
9	250	24	18.8	D. A.

TABLE 11.

Alloy.	Density Immediately After Quenching.	Density After Strengthening Began.
T	2.864	2.857
T	2.863	2.864
T	2.855	2.855
T	2.854	2.859
D. A.	2.764	2.764
D. A.	2.768	2.767

TABLE 12.

Specific Heats of—			
Alloy T Strengthened.	Un-strengthened.	Alloy D. A. Strengthened.	Un-strengthened.
0.196	0.198	0.199	0.200
0.200	0.198	0.207	0.206
0.200	0.201	0.206	0.207
0.195	0.196	0.205	0.207
0.198	0.198	0.205	0.205 Average.

Tables 11 and 12 show the results that have been obtained and need no further explanation.

INTERPRETATION OF THE RESULTS

The researches of the American observers, already mentioned, to solve the problem of the effect of the hardening of aluminum alloys start from the alloys containing copper. They showed that aluminum copper at 540° C. with 7% contained in solid solution, that the solubility drops with the falling of the temperature, and at 300° C. it amounts, moreover to only 1.5%. Now they say, in quenching, the precipitation ensues, to be sure, yet in such a finely divided state—a question of the combination, $CuAl_2$—that their mechanical properties could not still be shown. First, in the aging there appears to be a certain agglomeration of the particles, the tensile properties become more pronounced. Referring to the aluminum alloys containing copper, Dr. Jeffries states that the aging for one hour at 100° C. is about as effective as aging for four hours at room temperature; higher temperatures than 100° C. will effect aging more quickly (Bull. Amer. Inst. Min. & Met. Eng'rs, No. 153, p. 2498, 1919). Merica, Waltenberg and Scott had as-

sumed that in the quenching the precipitation followed in atomic dimensions. That was, as Jeffries quite correctly observed, to be sure, nothing else but a solid solution (Mischkrystall), therefore no breaking up or separation. This appears to the authors to be the kernel of the interpretation. By such assumptions many of the phenomena observed may, without further detail, be well explained: as the rapid alteration at the higher temperatures, the increase or the retrogression of the tenacity, if heated higher or longer (for then there appears larger conglomerations with properties again deteriorated) the failure of the strength at very low temperatures and the reappearance of the strengthening act with the increase of temperature, etc. That in the strengthened material also the precipitation would still be sub-microscopic must be assumed from the microscopic uncertainey of the precipitations in the normally strengthened alloys. One could bring the observed present course of the strengthening into agreement with this theory, finally also in explanation.

In comparison with this theory it can be objected that the same strengthening also appears in the zinc alloys and that there the solubility of the zinc in the aluminum is essentially greater. According to Bauer and Vogel (Int. Zeit. fur Met. V. 8 p. 119, 1917) it amounts at 443° C. to 40%; at 256° C. it still takes up 25%. The precipitation curve must therefore show an improbable rapid decrease of the solubility with falling temperatures. Furthermore, with an alloy lower in copper than in zinc at lower temperatures one must arrive in the region of solid solution. The only improvement of the temperature T-1 required must therefore be at a lower level, while the observations made here rather indicate the contrary. Whether the different degrees of dispersion alone can produce such a distinct mechanical alteration is also allowed to be not very probable.

Above all it appears that the increase of the line voltage by age approaches the conjecture that it is not a question of separation but rather the formation of a solid solution. Also with an increasing rate of dispersion one should expect a lessening rather than an increase of the resistance, as was observed by Parkhurst in steel wire, (Jour. Ind. Chem. 1918, p. 515-18; Stahl u. Eisen, 1919, p. 253). (According to Benedicks no alteration of conductivity takes place in the transition from sorbite into pearlite).

Also the observation that the resistance is again diminished when by heating there is a loss in tne strength, does not correspond to this, which is simply a question of a continuing agglomeration.

Another supposition brought forward by Guillet, to be sure only by a brief hint, that the strength of these alloys is entirely analogous to the occurrence of hardening in steel. The room temperature in this case is such that the "tempering effect" with it, runs remarkably rapidly. After that, therefore, occurred the instability; by means of quenching a characteristic condition was produced by weak mechanical properties, the stable condition was indicated by greater hardness and tenacity. On the other hand the observation indicates that frequently the strengthened condition is not absolutely stable, since, for example, in the T-alloy (See Table 6) already at 100° C. with the time noted, there sets in a remarkable recession of the tenacity; at the higher temperature, however, still below the temperature of the limiting boundary of the increase, the strengthening phenomena rapidly disappears. In this place it has already been shown in addition that 100° C. is a temperature at which the advancement in quality still takes place, therefore it is a fact that it cannot be a question of a sharp critical point; that, however, at the temperature reached below the point of the increase, the harder state likewise cannot be stable.

The phenomena observed in the T-alloy (Table 6) that at 100° C. the strength retrograded, yet also, after longer heating it did not entirely disappear, but remained constant; this phenomena compels the supposition that the strength is a question of the state of equilibrium depending upon the temperature. Corresponding to that, however, is the fact that after heating the test piece up to a temperature between T-1 and T-2 also in the cooling, the strengthening ceases (See point 4 under the most important phenomena). It is therefore not a question of actual stable equilibrium.

With all reserve the observers believe rather, that as a cause of the increased tenacity, the formation of a true chemical combination needs to be accepted, which is accomplished in the homogeneous solid solution phase. Molecular instability (in order to express it generally) as it is produced by the act of quenching, in one way, when the less instable combination also reaches the stable condition. The combination can exist then only when very instable components are present. For the time being, equilibrium always prevails corresponding to the existing temperature, as in slow cooling—no chemical action takes place.

PIPE BENDING HINTS*

After fifteen years of experience with work involving pipe bending it occurs to me that the following precautionary remarks may be of value or interest:

In bending large pipe fill with DRY sand and plug the ends. Heat to a red heat in localities to be bent end bend. Be sure that the sand is DRY. Where bends are slight it is often unnecessary to use sand or rosin. The object of sand or rosin is simply to keep the sides of the pipe from collapsing, or to prevent reduction of flow area. If wet sand is used, and if the ends are plugged, the pipe may burst when heated, due to the steam pressure generated.

Rosin, also, is good. But there is a "right way" and possibly several wrong ways to use it. An example of a wrong way was recently brought to my attention where the "mechanic" filled the pipe with rosin, plugged the ends and heated the pipe at the place where he wanted to bend it. He watched for a "red heat" just as he would had he filled the pipe with sand. The result was—a violent explosion.

The way to use rosin is to pour it into the pipe and allow it to cool and harden. As soon as the rosin is hard, bend the pipe COLD. Don't heat it. Then, after the pipe is bent, heat the pipe all over sufficiently to melt and remove the rosin.

There are many excellent mechanical devices on the market for bending pipe. To bend large, stiff pipe slightly, and inexpensively, there is nothing handier or more efficient, in my judgment, than a hydraulic pipe bender driven by a hand pump.

W. F. SCHAPHORST.

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WORLD'S ZINC SUPPLY

At present the world's chief source of zinc is the United States, which gained supremacy in the zinc industry when the war eliminated Germany and Belgium from this field, it is declared by the National Bank of Commerce in New York, in the November number of its magazine, Commerce Monthly.

Cleaning Metals for Electro-Plating

The Most Expensive Cleaning Methods are Methods Which Do Not Give Satisfactory Results—One of Prize-Winning Manuscripts in the Oakley Chemical Company's Prize Story Contest.

By J. H. RICHARDS.

The cleaning of articles for electro-plating is a matter bearing so directly on production, an operation so vitally and closely connected with the permanency and value of the subsequent finish, that it is small wonder that it has become a special study in itself. Its importance to modern industry is so thoroughly recognized that its demands have called into existence specialized organizations and industries to serve its particular and imperative needs.

The cleaning of metals would appear at first sight to be a very simple and easily performed operation, and so to some extent it is.

If expense and production were not considered, if the value and service of the finish of the manufactured article were no object, and if the health and comfort of the workers were not a factor, then the old methods of cleaning with caustic soda and lye, with benzine and gasoline, would still be in use.

To some extent these old methods are still in operation, just as there are countries where the wooden plow is still being used, despite the economy and effectiveness of up-to-date agricultural implements, and there are localities where the clothes are still being pounded on rocks in a brook, although the labor-saving marvels of modern washing machinery are a matter of common knowledge.

The use of benzine or gasoline in the factory for cleaning purposes is wasteful, expensive, unhealthy and dangerous. As a cleaning method, it has gone into the discard.

Caustic soda is cheap to buy but expensive to use. It is hard on the workers, making for sore hands, tender skin and unpleasant working conditions. It retains the dirt in solution, thereby daily lessening its efficiency. The time soon comes when the dirt, which is held in solution in a caustic soda solution, forms or settles on the immersed work, and castings or stampings suspended in the solution actually have dirt deposited on them. Used as an electric cleaner, caustic soda produces obnoxious poisonous fumes, necessitating the use of a special ventilating apparatus. It dissolves tin, attacks solder, and corrodes die castings. It has been weighed in the balance and found wanting.

The ever-increasing use in the industries of mineral oils and greases complicates the cleaning problems and makes necessary the addition of a small quantity of a suitable soap to the cleaning solution.

The ever-widening use of articles made of die castings and other easily corroded soft metals also calls for special consideration and treatment. It can be put down, as a rule, that having arrived at the best strength and temperature of the cleaning compound for that purpose, all die castings or soft-metal products must be handled and cleaned as quickly as possible.

The difficulty of obtaining suitable help and the importance of retaining them must be reckoned with in purchasing materials to work with. The cleaning compound of today then, to be practical, must be a help and assistance and must be fool proof.

The requirements, therefore, of a modern cleaning compound may be summed up as follows:

It must precipitate the dirt and not hold it in solution.
It must be able to remove mineral oil or grease.
It must work quickly.
It must tend to economy and production.
It must be simply and easily used under all conditions.
It must not give off noxious fumes.
It must not attack the hands of the workers.
It must not attack tin, solder, or die metal too quickly.

These I consider are the main requirements of a modern metal cleaner.

With regard to the operation of same it is impossible to lay down any exact rules; every shop has it problems. I would say, though, that it is important to find out how long it pays to run a solution, whether your work be extra dirty or fairly clean, whether your cleaning tanks be big or little. The time inevitably comes when it pays to clean out the solution and start anew. Ascertain that time and act accordingly. In spite of renewals nothing lasts forever. Do not wait until you have trouble before cleaning out a dirty, contaminated cleaning solution. Avoid trouble by starting a new solution before trouble starts. The writer is a firm believer in a hot rinse for all articles leaving the cleaning solution. Work may be subsequently run through an acid pickle or cold rinse, according to shop needs or conditions, but it must be remembered that all cleaning solutions are in effect soap solutions; if they are not made so they soon become so.

The grease entering into the solution daily will inevitably combine with the alkalies to form a soap. That being so, every piece of work taken from the cleaning solution has a soap-film covering, very thin, quite invisible, but present just the same. Now we immerse that article in cold water and the film of soap is congealed upon it. We rinse in hot water and the cleaning operation is completed. The electric current has long been in use as a help in cleaning. A suitable cleaning compound forms the solution, which should be kept boiling. A sheet steel tank is the container and anode and the articles to be cleaned are the cathodes. This manner of connecting is called the direct current and is undoubtedly the quickest and best way.

An addition to these cleaning methods, or what might be called an improvement in cleaning operations, is what is called the copper clean and strike. By this method the work is cleaned and receives a bright, adherent coat of copper almost instantaneously. Wherever shop conditions allow of or favor this operation this process of cleaning is quick, efficient and thorough. The solution consists of a suitable cleaning solution as a base, with the addition of one ounce of sodium cyanide and one ounce of copper cyanide to the gallon, using the steel tanks as anode and using a few supplementary copper anodes. This solution will remove rust, dirt, grease, paint or japan, and will deposit a heavy enough coat of copper for any subsequent finish if desired.

In conclusion, I would say this, that in electro-plating, as in many other operations, cleaning is a very important part of the finished process. That while the cost and expense of cleaning must, of course, be considered, still it is not always an economy to try to save money on cleaning. That it will often be found to be a place where an increase in the cost of this operation will decrease cost per piece of the manufactured article and will be money well spent. The most expensive cleaning methods are methods which do not give satisfactory results.

EDITORIAL

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PLATING WORK OF THE BUREAU OF STANDARDS

In the Monthly Review for September, 1920, was published a report of the electro-plating investigations conducted by the Bureau of Standards, which was submitted to the American Electro Platers' Society at the Rochester Convention, July first, 1920. The report will interest all electro-platers and should interest all manufacturers who have plating departments. Dr. Blum, who is in charge of this work, gave a general summary of the ground covered, which was roughly, as follows:

1. During the first part of the fiscal year, the work upon the effect of pickling on the physical properties of steel was completed and the results were published. It was impossible, however, to complete the work planned, upon the effect of plating operations on the physical properties of steel. It is hoped to finish this investigation.

2. Some time was devoted to the study of zinc plating solutions, but it was impossible to carry these experiments to completion. Dr. Blum adds that the subject is greatly in need of study and that the work should be carried on as soon as possible.

3. Most of the time during the year was given to help the Bureau of Engraving and Printing in the installation of a new plant for the electrolytic production of printing plates. The plant is now in operation and producing plates which have yielded very satisfactory service.

4. Illustrated lectures upon the structure of electro-deposited metals were given to branches of the society located in a number of the principal cities. Dr. Blum stated, among other things, that although the Bureau of Engraving and Printing called for so much attention that it was impossible to carry on any other extended or fundamental investigations, the knowledge and experience gained in connection with the operation of copper and nickel solutions would be of value both to electrotypers and electroplaters. This knowledge will, of course, be made public as far as possible.

Because of reduction in the appropriations, the funds for the coming year for research work on plating will be less than in the past. It was asked that the American Electro Platers' Society secure funds through co-operation of manufacturers for conducting additional investigations, which the Bureau cannot afford at present. Also, that platers should be urged to send to the Bureau any requests for information desired, or any new or unusual observations of their own.

There is no question about the significance of this report. It is an honest statement of work done, work attempted and work dropped because of lack of funds and facilities, and a frank admission that much work should be done which cannot be attempted without financial help. Whether we like it or not, whether we agree

with the policy of Congress in cutting the appropriation of the Bureau of Standards or not, we are forced to recognize that this condition exists and the best must be made of it. The electroplating section of the Bureau of Standards is almost completely tied up by work for other Government departments. The only way in which it can be enabled to aid the electroplating industry as a whole is by the financial aid of that industry. Without that, practically nothing will be done in the coming year on new and original investigations. It will be useless for electroplaters to communicate their difficulties to Dr. Blum if he has neither money nor the facilities for overcoming them. To be sure, the published records of the work done on nickel and copper for the Bureau of Engraving and Printing will be very valuable, but this is only a small part of the work that should be carried on. Money is necessary, not for sentimental reasons, but because this section can be made a dividend-paying organization. It is a truism that no art stands in need of research more than electroplating, and that nobody is better fitted to carry on this work than the Bureau of Standards. The American Electro Platers' Society should begin work at once to obtain funds which will enable the Bureau of Standards to carry on such work.

BRONZE DIE CASTING

At the Columbus Convention of the American Foundrymen's Association, Charles Pack of the Doehler Die Casting Company read a very interesting paper on the Relation of Die Casting to Foundry Practice (a report of which was published in our October issue, page 445). Mr. Pack stated that so far no metal had been discovered which had the necessary properties for use in molds for casting brass and bronze. These properties were as follows:

1. Heat resistance. The material must not scale or oxidize at the temperatures of 1,600 to 1,800 Fahr.
2. Expansion. The material must have a very low coefficient of expansion.
3. Elastic Limit. The material must have a high elastic limit.
4. Conductivity. Low conductivity is necessary to enable the metal to fill the cavities of the mold without the use of high pressure.
5. Strength. The material must have an extraordinarily high tensile strength, if small cores are to be cast.

In a recent number of the Iron Age a letter was published from Mr. Thomas W. H. Jeacock, President of the Buffalo Bronze Die Cast Corporation, Buffalo, New York, in which he stated that his company was casting aluminum bronze of the composition, copper 90, aluminum 10, in metal dies and had been doing so for three years. His letter ran in part as follows:

"The smallest pieces we have run weigh 360 to the pound, and the largest piece 12 lb. We have cast an outside thread on a casting made in two pieces which, when assembled, had to be in perfect alignment. The thread was 20 pitch. We have run a die well past the 35,000 mark. We have accomplished the coring of holes, with metal cores, to a degree of accuracy of plus or minus one-half thousandths of an inch on holes ½ in. in diameter and as deep as 1½ in.; on casting of teeth on bevel gears as large as 4 in. in diameter to a degree of accuracy on tooth parts of plus or minus one-thousandth. We have been commercially casting teeth in worm gears in metal dies for two years. Our deliveries on this piece have run as high as 500 per day. The gear weighs 12 pounds."

Here we have decidedly a strange situation. Both men quoted are responsible and reputable. It seems clearly safe to say that in general Mr. Pack's view has been the accepted one. But if bronze die castings are being made, they have been unfortunately set back in the eyes of manufacturers by the large number of concerns who have tried and succeeded in producing a few castings of this type, but who later found that it was not commercially practicable. The record of the last few years is one of failures in this field, but that, of course, may mean nothing in this particular case. We hope to publish more in the very near future about the work of the Buffalo Bronze Die Cast Corporation, and in addition, would like to hear from others of our readers about their experiences along these lines.

ALL METAL AIRPLANES

The recent spectacular growth in the use of Duralumin in airplanes, which developed into the building of machines entirely from this alloy, were brought most forcibly to the attention of the aluminum trade and the general public by the accidents which occurred to the two planes in the Division of Air Mail Service, resulting in the loss of four lives. It was only natural that under these circumstances aluminum would receive a set-back as an airplane material, even before any reports from authoritative sources could be published, simply because of the publicity which these accidents received, and the fact that their peculiar construction had been so widely heralded.

With the view of obtaining accurate information, we wrote to the Division of Air Mail Service in charge of the Second Assistant Postmaster General, whose letter, quoted below, speaks clearly for itself:

"In discussing the accidents and causes which led up to them, it must be borne in mind that while the plane was of all metal construction and, therefore, non-inflammable, it was the gasoline and oil that did the burning, and it must, of course, be understood that gasoline and oil will burn if ignited, regardless of the material of which the container is built. One fire occurred previous to the two above mentioned, which the aviator was able to extinguish on account of the height at which he was traveling when it broke out. The undoubted cause of this was the breaking of the gasoline feed pipe to the carburetor, which caused the engine compartment to be flooded with gasoline and caused the engine to be starved at the same time. This, of course, resulted in back firing, which ignited the gasoline pouring into the engine section through the broken pipe. The pilot was able to shut off the gas flow from the tanks, put the ship into a side slip, thus allowing the flames to escape from the side of the compartment rather than to come back into the pilot's cockpit, and in this way made a safe landing after the fire had burned out. The only damage to this machine was the burning up of the insulation on the ignition wires, and the melting of one or two holes in the thin sheet metal sides of

the engine section. The ship was flown away from its point of forced landing after the accident.

"In considering the causes of the other fires, it should be borne in mind that the rounded underside of the fuselage of this machine acted very much as a large basin in which leaking oil and gasoline could collect. While the pilot was flying in a level position, or climbing, the gas and oil for which no outlet had been provided save where it leaked out of the overlapping plates in the metal skin, collected in the lower part of the fuselage and flowed to a point somewhat to the rear of the pilot and the pilot's compartment.

"This leakage seems to have been a frequent occurrence on these machines, especially at connections in the gasoline piping system, which required the very closest attention to keep them tight. When the ship was nosed down to descend, the low spot in the fuselage naturally shifted up under the engine, and the leaking gasoline would flow to that point; then, after back firing occurred, the liquid and fumes, which had been ignited in the engine section would burst into flames, which would seek an outlet through the pilot's compartment. Unless the pilot had a great deal of altitude, as mentioned in the first case, the ship would crash to the ground while the liquid in the engine section was still ablaze, the pilot being unable to make a good landing on account of being more or less blinded by flames and smoke. When the machine crashed to the ground it was only natural that the fuel tanks should be broken and add their contents to the conflagration. Thus it can be seen that the structure, while proof against taking fire from outside causes, could not, of course, prevent conflagration of any inflammable contents which might be ignited from within.

"At the present time a conventional type of gasoline system is being installed in these machines to eliminate, so far as is possible, danger from such leakage in the future. In addition to this, holes for draining and ventilating are being provided, and the air intake to the carburetor through which back firing occurs, is being carried to the outside of the machine, where it discharges into the air. It is confidently expected that these provisions will utterly eliminate any future damage from fire."

October 28, 1920.

E. R. WHITE, Second Assistant Postmaster General.

It will be seen, therefore, that the cause of trouble with all metal planes, has not been anything which was inherent in the material of which they were built. As a matter of fact, no other planes would have been able to last as long under similar circumstances. With the changes in the construction mentioned by Mr. White, which will eliminate, first of all, leakage, and, secondly, any possibility of the gasoline collecting in the fuselage of the machine, if it ever should leak, there is no reason why this plane should not become safer than any other in use.

INVENTION RIGHTS

Of deep interest to manufacturers is the decision of the Supreme Court of Pennsylvania in upholding the judgment of a lower court which had ruled against the employer in the case of the rights of ownership over an employee's invention. The White Heat Products Company of Frazer, Penn., manufactures silica products. When it made a contract with Charles W. Thomas it was manufacturing bricks, etc., from white silica mixed with glass. Thomas entered their employ as an expert on this kind of work, and in joining this company assigned his interests in certain patents. Among these patents was one which related to a furnace for making products of this type and he assigned to the company the right to make, use and sell these furnaces. Also he gave them the right to every invention which he would make during his period of employment with them and for one year afterward, relating to the manufacture of "bricks, stone products, earthenware products and analogous and collateral products."

For some time he continued experiments and all the patents he secured were assigned to the company. Up to 1914, however, the work was unsuccessful. Thomas began to experiment by himself, after working hours, on a process for making an abrasive wheel for use in grinding metals. Later, after a discussion with the president of the company, the experiments were carried on at the company's plant and at its expense pending an agreement. They proved successful and samples were marketed before the agreement for the manufacturing of this product was concluded. Subsequently, however, this agreement fell through and the company claimed that the invention belonged to it under the original contract.

In its ruling, the court stated that due to the fact that the law in cases of this type demanded that the contracts must be clear and unmistakable in their language, and that since this particular contract was open to more than one construction, this contract could not hold. The ambiguity existed in the wording of the sections covering the materials to be used in the grinding wheel. The original contract had assigned to the company all inventions relating to "bricks, stone products, earthenware products and analogous and collateral products," but an abrasive wheel, although made to a great extent of bauxite clay, could not come under the heading of earthenware products. The company urged the point that the experiments on this wheel had been run at their expense and on their property, but the court ruled that since the invention had been planned and the preliminary work had been done outside of working hours and in an outside plant, this rule did not apply. The judgment was therefore given in favor of the employee.

NEW BOOKS

Chemical Analysis of Steel Works Materials by Frank Ibbottson, B. Sc., F. R. C. Sc. I., F. I. C., co-author of the Analysis of Non-Ferrous Alloys, and the Analysis of Steel Works Materials. Published by Longmans, Green & Company, New York. Size 5½ x 8½. Price, payable in advance, $7.50. For sale by The Metal Industry.

This work is a new and revised edition of the analysis of steel works materials (which was published in 1902), and in particular the section on pyrometry and microscopy. It covers the analysis of raw materials and finished products of a steel works, and includes general processes and miscellaneous notes on the analysis of steel and pig iron, the analysis of steel making alloys, the analysis of ores, the analysis of refractory materials, the analysis of slags, the analysis of fuels, and the analysis of boiler water, slags, etc. A detailed description of this standard work is unnecessary, as the author has long been known as a careful, conscientious and accurate chemist. This, like others from his pen, is generally considered authoritative.

CORRESPONDENCE AND DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

PLATING BOOKS

To the Editor of THE METAL INDUSTRY:

The much-heralded eighth edition of Langbein's Electro Deposition of Metals has recently appeared from the press of Henry Carey Baird & Company.

Dr. Langbein's original work has always ranked as a foremost authority upon electro deposition of metals ever since the appearance of the original edition published in 1901 by the above concern. Each succeeding edition has noted the advance made in the art so that the work has continued to be an authoritative and complete source of information for the practical electroplater and for others interested in the art from its chemical and commercial standpoint.

The eighth edition, however, is a disappointment. Very little improvement or additional data has been added that makes the work of any great advantage over the seventh edition published several years ago.

The five years preceding 1920 were very fertile in the advancement of electroplating. The entry of the United States in the world's war in 1917 was the forerunner of unusual demands made upon the American electroplater and he was equal to the demand. The reviser could have found much data that would have proven of value in the eighth edition if he had sought diligently. The pages referring to the methods of standardization for solutions, replenishing, etc., however, make a valuable addition. On the whole Langbein is still an authoritative source of information to all interested in the art of electroplating.

The Modern Electro-Plater by Kenneth M. Coggeshall, Electrical Engineer, recently from the press of the Norman W. Henley Publishing Company, New York, is a parody when compared with the works of Langbein, Watt & Phillips, Field, or Barclay & Hainsworth. A better title for the work and more in keeping with the contents of the book would have been the Electro Platers' Material Catalog. Its pages have been devoted to a great extent to exploiting the wares of dealers in plating equipment, etc. The index covers 20 pages, and data on electroplating 21 pages which could have been readily covered in half the space.

I marvel at the man who presumes to write such a work and claims to cover the modern art of electroplating. Mr. Coggeshall evidently knows nothing of the art of electroplating himself or he would never have written such a book and given it the title he has.

It is a mess of pottage, a rehashed recopied proposition. Its pages give only data that is already known to every electroplater who presumes to know anything at all about the art. Such data has been published time and again by so termed authors of works on electroplating.

The American electroplater seeks knowledge that will prove of value to him, but has become disgusted with publishers' exploitation for their own advantage. The American electroplater will spend his money freely for authoritative data upon electroplating that will accrue to his advantage, but not for such works as Mr. Coggeshall has written. The only redeeming feature of Mr. Coggeshall's work is the part devoted to the engineering methods of electroplating, written as an electrical engineer.

In the writer's opinion no authoritative work worthy of the name, covering modern electroplating, can be written by one man unless he has unusual talent. The work to be of the utmost value must be from the pens of men who thoroughly understand electro chemistry as a basis and modern electroplating in all its details, from the practical as well as from the theoretical standpoint.

October 15, 1920. CHARLES H. PROCTOR, New York.

NEW ROLLING MILL

To the Editor of THE METAL INDUSTRY:

Relative to your request for information regarding the construction of a rolling mill for this company, the following is the only information for publication at present:

"The International Nickel Company has decided to have constructed as early as possible a rolling mill for the production of Monel Metal rods and sheets. The works which are estimated to cost about $3,000,000 will be located at Huntington, West Virginia.

"An excellent site of 75-acres has been acquired at Guyandotte, just outside the city limits of Huntington, which will not only provide for the rolling mill, but for any future business expansion in this direction.

"The site is conveniently located to both the B. & O. and the C. & O. railroads and access may also be had to the property from the Ohio River. The works will be operated entirely by electric power and natural gas will be used for heating and annealing furnaces.

"The construction of the works will be carried out by the engineering department of The International Nickel Company, and it is expected ground will be broken before the first of the new year.

W. L. WOTHERSPOON, Consulting Engineer.

"New York, November 3, 1920."

ALUMINUM COMPANY ISSUES NOTES

The Aluminum Company of America has issued $12,000,000 worth of five-year 7 per cent gold notes, dated November 1, 1920 due November 1, 1925, interest payable May 1 and November 1. Price 97½ and interest, yielding over 7.60 per cent.

These notes will be a direct obligation of the company issued under a Trust Indenture prohibiting the creation of any secured indebtedness upon the properties of the company. Earnings, after interest, taxes and other charges, since 1915, were over $10,000,000 annually. It is stated that current assets are in excess of $50,000,000; total liabilities less than $32,000,000. Equity, as indicated by quotations of the company's stock, is in excess of $110,000,000. The notes have been fully subscribed.

STANDARD PARTS COMPANY

The committee of creditors of the Standard Parts Company, Cleveland, O., has come to an agreement with the committee representing the preferred and common stockholders whereby a reorganization will be effected and new issues of preferred stock will be sold providing the company with additional capital in the amount of approximately $6,000,000, and that arrangements will be made with certain banks for lines of credit of $4,000,000.

Conditioned upon such plan being declared effective and such additional capital being provided, the former committee has adopted a plan whereby there will be paid to all creditors 40 per cent of their claims December 15, 1920, and the balance to be paid in three equal payments on or before four, eight and twelve months respectively thereafter, for which the promissory notes of The Standard Parts Company will be given payable with interest at 7 per cent per annum from the date thereof. All accounts in amount under $200 will be paid in full December 15, 1920.

AMERICAN METALLURGICAL CORPORATION

On October 1, the District Court of the United States, for the Eastern District of Pennsylvania, appointed William H. Creamer, Jr., 1207 Lincoln Building, Philadelphia, Pa., as receiver, authorizing him to take over the business of the defendant company. The future of the company will depend upon the further order of the court, after the receiver has had an opportunity carefully to investigate into its condition. F. J. Ryan is the plaintiff.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; CORYDEN P. KARR, Exchange-Research

CORROSION PREVENTION

Q.—We are mailing under separate cover three brass clips. They are used in developing films for Kodaks. One in brass, two nickel-plated, one has not been used at all, and the other one has been used three months, the nickel does not protect the brass long enough. You will note that the third clip, which has been in use three months, is all corroded and the chemicals we use seems to eat through the plating on to the brass and consequently weakens the clip and makes it unfit for further use. What is the difficulty? How can we prevent this?

We are enclosing formula of fixing bath and hardener used in developing films:

Fixing Formula.

228 Lbs. Hyposulphate of soda crystals
114 Gallons Water

Hardener.

14 Lbs. Sodium Sulphite Powder
20 Lbs. Alum
5 Gal. 44 oz. Acetic Acid (28 per cent.)

Nickel Plate.

1½ Hours 2 Volts

A.—Evidently the nickel is not affected to any great extent in the fixing bath and hardener used in developing films.

However, it appears from the sample that is so badly corroded that just as soon as the nickel becomes worn through, showing the brass in any one spot, the developing solution appears to work under the nickel-plated surface and eats out the brass, leaving eventually nothing but a shell of nickel.

It is the acetic acid that eats up the brass. The only suggestion we can make is to try lead plating on top of the nickel and note results. A thin deposit of lead will increase the life of the clips and may solve the problem.

Prepare a lead solution as follows:

Water	1 gallons
Rochelle Salts	3 ozs.
Caustic Soda	1 oz.
Lead Cyanide	2 ozs.

Heat the solution to 160° Fahr. Use lead anodes; voltage from 1 to 2.

Nickel plate as usual; after plating wash as usual, then lead plate for five or ten minutes, then wash and dry, and make note of results under usual conditions.—C. H. P. Problem 2,880.

ENAMELING STEEL AND IRON

Q.—How can I apply white porcelain to iron and steel?

A.—The application of porcelain enamels to steel or iron requires experience and skill that can only be obtained through practical experience. It would be advisable to secure a practical porcelain enameller, one that thoroughly understands the various compositions, that can prepare the "frit." This is the enamel glass that must be afterwards ground to a fine powder in stone or pebble mills, etc., and more especially the firing of enamels.

We would suggest that you secure a copy of Enamelling on Iron and Steel, Theory and Practice, by Julius Grunwalk and H. H. Hodgson. This is a very practical work upon the subject.

Henley's 20th Century Book of Recipes, Formulas and Processes covers the process to a great extent in pages 290 to 309.

Briefly mentioned, the manipulations are as follows:

1. Cleansing the steel or iron from grease scale or oxide, by the usual alkalis and acid pickles.

2. Preparation of the "frit" or enamel glass which consists of fusing the component parts of the enamel at the proper temperature, 2200 to 2500° Fahr.

The molten enamel is allowed to run into cold water which splinters it and produces a very thin friable glass.

The "frit" is later ground to a powder in stone or pebble mills with water.

A combination for white enamel much used on ordinary white enamel cooking utensils is as follows, though cheaper combinations may be made:

1. Powdered Borax	200	parts
2. Feldspar	120-130	"
3. Tin Oxide	68	"
4. Ball or China Clay	20	"
5. Soda Ash	8	"
6. Potassium Nitrate	2	"
7. Natural Cryolite	40	"
8. Ammonium Carbonate	3	"
9. Fluorspar	2	"
10. Magnesium Carbonate	2	"

After grinding the enamel is ready for applying to the steel. If only one coat is to be applied then the formula given may be used. It must be sufficiently thick when applied so that in the heating the steel will be completely covered and retain a good glaze. When two coats of enamel are applied the first is termed the ground or body coat, the second the glaze.

A fusible white body enamel is prepared similar to the following mixture:

Feldspar	60	parts
Borax	42	"
Tin Oxide	12	"
Soda Ash	15	"
Saltpetre	2	"

The enamel when applied to the iron or steel must be dried thoroughly and as quickly as possible to prevent rusting of the steel which frequently causes trouble of chipping. Enamel will not adhere to the oxides or rust.

The fusing temperature of the applied enamel is about 1400 to 1500° Fahr. The first or priming coat is fired for a few minutes, the second or finishing coat from 10 to 15 minutes. Usually the temperature is lower for the second coat.

Any method of heating may be used that will give uniform temperatures up to 1800° Fahr. Gas is used to a great extent.—C. H. P. Problem 2,881.

FOUNDRY EQUIPMENT

Q.—We write to ask your opinion on the best melting equipment for brass foundry in connection with a jobbing and manufacturing shop, figuring on five moulders.

A.—We would suggest that for a small foundry doing jobbing work, you should be very cautious about buying any expensive automatic machinery. Jobbing work is very diversified in character, and as you undoubtedly know, calls for very frequent changes.

It seems to us, knowing little as we do, of course, about your particular problem, that you should have a few pit-fires, say 5 or 10, and perhaps one open flame oil fired furnace. This can be used to good advantage in case of rush work or can be used separately at any time. It should be borne in mind, however, with regard to the open flame furnace, that oil is not only very expensive, but very hard to get.

With regard to the pit-fires, we have seen a number of cases where the builders of brass foundries have made the same mistake, that is, in having the stack too small. It will be well to remember that unless you have a forced draft under your crucibles, your stack will do all the work in keeping your fires going hot. We cannot give you details because we do not know how large or what sort of installation you contemplate. However, we should be very glad to go over these details with you and give you any further advice in our power.—A. B. Problem 2,882.

FROSTING WATCH DIALS

Q.—How can I produce a frosted finish on silver watch dials?

A.—Take a piece of fine cork about 10 inches square and 1 inch thick and place the wheels on this cork, fastening them on by a

pin through the hole in the center of the wheel. Make a mixture as follows:

30 grams fine silver powder,
1000 grams cream of tartar.
1500 grams common salt ground fine,

mix with common water so as to form a sort of paste, not too thick or too liquid.

This mixture should be prepared in a porcelain or glass receptacle and kept covered to prevent dust from getting in. A certain quantity of this mixture is laid upon the surface of the wheels and the wheels are then brushed vigorously, the cork being turned about from time to time so as to get the lines of brushing to cross one another constantly. The wheels become white and matted and the brushing is continued until the grain gets uniform and covers the whole surface of the wheel. If a very fine matted effect is wanted the proportion of cream of tartar can be increased and the proportion of salt diminished. When the wheels are nicely matted, clean them in pure water, and put them immediately in the gilding solution. A little experience is necessary to obtain the right thickness of matting mixture, to know what quantity of mixture to use, the length of time to brush and the quality of brush to use, but when nicely operated this process will produce a very fine even matted surface.

The silver powder is prepared by dissolving ⅔ ozs. Nitrate of Silver in two gallons of cold water. Into the solution place about ½ dozen strips of thin sheets of copper, about one inch wide, and long enough so that it remains above the solution. The silver will deposit upon the copper strips, but does not adhere. Occasionally shake the strips and the silver will fall from the copper. Repeat the operation as long as the silver deposits. Finally filter the silver from the solution and use it as the silver powder.

The copper nitrate formed in the solution is of no value and may be thrown away.—C. H. P. Problem 2,883.

GOLD MELTING

Q.—Please tell me the cause of blisters in gold bars.

A.—It is hard to give a diagnosis of troubles upon such a slender statement of facts. In consequence my reply cannot be direct nor to the point, but predicated upon what is assumed to be the case. Blisters may result, if gold is poured into cold molds. The metal then becomes agitated and craters are formed, some of which become covered in the process of rolling, when upon becoming again heated the blisters show themselves. Pouring at too great a height from the mold will entrap air which will cause blisters upon annealing this metal.

A failure to start with absolutely pure metals in the alloying work may introduce a foreign element that will cause porosity and blisters. If alloy is rich in copper and the metal bath not sufficiently protected from the atmosphere, an oxidized condition will result, causing blisters. Fine gold of high grade will not blister. Eighteen carat gold with ordinary care and knowledge of above named facts will cause no trouble in melting. Grades with a higher percentage of alloying material offer greater opportunities for trouble. Have gold of tested purity and use electrolytic copper. Cover the melt with ground charcoal. Pour at not too high a temperature and few, if any, troubles will result.—H. D. C. Problem 2,884.

HANDLING LACQUER

Q.—Have used thinner or R. E. Bed Lacquer, as it is now called, for 20 years. Recently four glass containers broke and lost quite a lot of it. Great care has always been taken in handling the material. Please give a reason for this trouble if you can and oblige.

A.—Lacquers or thinners should never be put in glass bottles. There is always danger due to breakage, especially so in the summer time, when the liquids become warm and expand considerably. The combinations used in lacquers and thinners have changed during the past five years. They no longer consist of amyl-acetate and fusel oil, but are made up from hydrocarbon liquids, to a great extent, which expand considerably above 70° Fahr. The expansion is always outward. There is no doubt but the breakage of the bottles containing the thinners or lacquers was due to this cause. Use cans made up from a good grade of tin plate to hold your lacquers and thinners, and you will not have recurrence of the trouble of breakage of the containers.—C. H. P. Problem 2,885.

TERNE METAL AS RUST PROOFING

Q.—By separate mail we are sending you some radiator hose connections which we have attempted to coat with a terne metal application consisting of 50% tin and 50% lead.

In the first instance these castings are purchased from a smelting company who buy up all the obsolete radiators; when we receive these castings they are in a bad, rusty condition. So that we do not get ahead of our story we might say that these castings, when originally made up, are usually coated with a terne metal coating, or tinned. The first procedure we go through after receiving the casting (rusted) from the smelting works is to put them in a bath of hydrofluoric acid which is slightly heated. We figure this bath will loosen up the sediment or rust and scale. After the pieces have been submerged in this bath a sufficient length of time we put them in water rattlers and roll the castings with flint stone and jacks. This operation we figure removes the rust which the acid bath has loosened. After this operation we repeat the acid bath and the water rolling. The next operation is to submerge the casting in a strong solution of hydrofluoric acid prior to submerging them in the lead bath. We have tried our metal bath both with and without flux and we find there is practically no difference in the finish either way we run the castings through.

The entire operation seems to work out successfully as to coating and after the casting is brought from the bath and dipped in cold water it shows up a very bright and clean finish, but after this casting has been in the tray about one-half hour it begins to show up a strong rust action, and the rust coating is similar to that which you will find on the sample casting we are sending you.

A.—Terne metal composed of 50 lead, 50 tin applied in the molten state does not give a protective coating against rust. It would be more satisfactory to galvanize the radiator hose connections either by the molten zinc method or by electro-zinc plating.

Zinc is the only metal that will prevent iron or steel from rusting. However, you can avoid the rusting under your present method if you quench the castings after coating with the terne mixture in paraffine oil instead of water. It is the water that remains upon the coated castings that develops the rust. You might overcome the trouble by tumbling for a few minutes in maple sawdust heated to about the boiling point of water. However, zinc coating would be preferable. No change in your methods of manipulation would remedy the trouble otherwise than stated.—C. H. P. Problem 2,886.

SILVER MELTING

Q.—I tried a certain experiment with silver, but failed to obtain the desired results. I will herewith describe this experiment, so that you may be able to point out the cause of failure.

I took one ounce of scrap silver, dissolved it in diluted nitric acid, and obtained chloride of silver. Then I washed and dried it. I then mixed it with twice the weight carbonate of soda, and half the weight of fine charcoal. I put this mixture in a crucible and heated it to obtain the metal out of it. The result was that this mixture stuck to the crucible, and the desired metal did not come out.

I do not know the cause of this result, whether I did not heat it long enough, or the mixture was not right. I heated the mixture for 15 to 20 minutes. It was all melted, but when cooled I could not obtain the silver from the crucible.

A.—We believe that your difficulty is due to insufficient heat. We would suggest that you adopt the following procedure: Mix one part of silver chloride with four parts crystallized sodium carbonate, and one-half part of pulverized charcoal. Mix very thoroughly and then dry so that no moisture goes into the melting furnace. Heat until the whole material is completely melted and flows as thin as water. It may be feasible before allowing the crucible to cool to tap it gently on a stone or metal floor, in order to force the particles of silver in the mixture to drop to the bottom. Do not jar the crucible too hard, however, as it may scatter the silver throughout the charge again, and perhaps even break the crucible. Allow it to cool and then break up. You should find a button of silver at the bottom.—A. B. Problem 2,887.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,345,160. June 29, 1920. **Box for Forming Molds.** Edward Fries, Moores, Pa. Filed Oct. 11, 1919. Serial No. 330,075. 5 Claims. (Cl. 22—106.)

The combination of a box in which a mold is formed, said box having permanent side and end walls and movable side plates located within the box; and means for adjusting said movable side plates without disturbing the permanent structure of the box.

1,345,161. June 29, 1920. **Pit-Flask for Castings.** Edward Fries, Moores, Pa.

The combination in a flask adapted to be located in a pit, of fixed end walls and side walls located between the end walls, one of said side walls being adjustable; and an adjustable bottom located within the flask and supporting the mold.

1,345,162. June 29, 1920. **Process of Preparing Molds for Casting.** Edward Fries, Moores, Pa.

The process herein described of making molds for castings, said process consisting in first placing a pattern within a forming box, making a mold within the box, placing a bottom plate on the mold, inverting the box, removing the box and pattern from the mold, baking the mold while on the bottom plate without a flask, then carrying the mold by the bottom plate to a fixed flask having an inner dimension of a size to receive the bottom plate, lowering the bottom plate, with the mold, into the flask, and closing the flask for pouring.

1,345,354. July 6. 1920. **Lacquer Enamel.** William F. Doerflinger, Arrochar, N. Y. Filed Feb. 6, 1919. Serial No. 275,328. 7 Claims. (Cl. 134—79.)

An enamel lacquer containing sufficient suspended tannic oxid to render the dry film formed on evaporation of a layer of the lacquer enamel opaque to actinic light.

1,345,441. July 6, 1920. **Process of Drawing Refractory Metal.** Junzo Hisamoto, Nagoya City, Japan, assignor to Toyo-Kagaku-Yakin-Kabushiki-Kaisha (The Oriental Chemical Metallurgic Company, Limited), Tokyo, Japan.

The method of drawing refractory metal to a filamentary diameter which consists in surrounding a refractory slug of metal with a refractory oxid, placing these evenly in a metal tube, drawing the tube and contents to a filamentary size and removing the tube and oxid from the inclosed refractory metal.

1,345,749. July 6, 1920. **Method and Apparatus for Cooling Ingot Molds.** Ray G. Coates, Pasadena, Cal., assignor to Valley Mould and Iron Corporation, Sharpesville, Pa., a corporation of New York.

A cooling device for large castings, such as ingot molds and the like, comprising in combination a chamber adapted to receive hot castings, a suitable floor within said chamber, a conduit for withdrawing air from said chamber, and means to control the withdrawal of the air, said chamber being constructed to provide for the removal of the cooled castings and the addition of hot castings, the means to control the air being operable to cause the air current to proceed from the cool castings toward the hot castings.

1,345,976. July 6, 1920. **Electrical Furnace.** Raymond Samuel Wile, New York, N. Y.

A furnace having a resister provided with current paths in parallel decreasing in length from the outside inwardly.

1,346,190. July 13, 1920. **Firearm and Alloy for Making Same.** Frank A. Fahrenwald, Cleveland Heights, Ohio.

A firearm barrel made of an alloy containing copper alloyed with not less than about twenty-five per cent. of nickel.

1,346,369. July 13, 1920. **Ingot-Mold.** John A. Drain, Philadelphia, Pa.

An ingot mold having a lining of refractory material and an inner lining of heat insulating material.

14,914. July 13, 1920. **Metallurgical Furnace.** Samuel M. Howell, Zanesville, Ohio.

In a metallurgical furnace using air and gas or a hydrocarbon vapor as fuel, the combination of a mixing chamber containing a body of metallic chips with a refractory upper retaining plate substantially as set forth and described.

1,346,854. July 20, 1920. **Electric Furnace.** Edwin Leonard Smalley, East Orange, N. J.

The combination, with an electrical furnace having a series of heating units, of horizontally shiftable supporting elements within said furnace for said heating units whereby the latter are rendered both adjustable and renewable.

1,347,728. July 27, 1920. **Method and Apparatus for Molding or Casting Articles or Ingots from Molten Metal.** Edwin Cooper Wills, Frederick, Md.

A method of molding or casting metals, which consists in placing the molten metal in a mold and in filling the mold to a higher level than the ultimate dimension of the article desired in one of its axes, and in subjecting the molten mass to pressure prior to its ultimate solidification by an agent having a rigid unyielding compression surface, whose area is equal to that of the surface of the adjacent end of the article, and which engages the said end throughout its entire area, and which, simultaneously with its engagement with the molten metal cuts off the flow of metal to the mold.

1,348,215. Aug. 3, 1920. **Metal-Bending Machine.** Samuel H. Gibson, Cleveland, Ohio, assignor to The Fanner Manufacturing Company, Cleveland, Ohio, a corporation of Ohio.

In a machine of the character described and in combination a bed die having a recess formed therein, oppositely disposed movable members normally located above and at the sides of the recess in the bed die, the front faces of said movable members forming continuations of the sides of the recess in the bed die and serving as parts of said die during the initial bending of a strip of metal, said movable members being adapted to receive and support a strip of metal to be formed, a forming die mounted above said movable members and adapted to descend to press the strip of metal between said movable members and into the recess in the bed die, means for operating the said movable members to reciprocate them across the recess in the bed die thereby to fold the said strip of metal about the forming die and a heading die mounted above the forming die and adapted to descend and press the metal strip which has been folded about the forming die.

1,348,351. Aug. 3, 1920. **Apparatus for Coating Castings.** John Dixon, Monaca, and John M. Shaffer, New Brighton, Pa., assignors to United States Sanitary Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania.

Apparatus for use in coating castings, comprising a supporting device having supports arranged in pairs and arranged to support two castings in oppositely inclined positions, and other supporting members arranged intermediate the supports of each pair of the first named supports and adapted to hold said castings in other positions, substantially as described.

1,348,361. Aug. 3, 1920. **Method and Apparatus for Coating or Enameling Metal.** John S. Jobe, Rochester, and John Dixon, Monaca, Pa., assignors to United States Sanitary Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania.

In the art of coating metal castings, the method which consists in supporting the casting to be coated in an inclined position

with one of its surfaces exposed to coating operations, coating such surface, and then turnng the casting into a reverse inclined position to expose its other surface without removing it from its support and coating such other surface, substantially as described.

Apparatus for coating castings comprising a supporting device having supports for holding a plurality of castings each in different inclined positions and to permit the castings to be turned thereon without removal from one of such positions to the other, substantially as described.

1,348,457. Aug. 3, 1920. **Process for Deoxidizing Copper and Its Alloys.** Albert Strasser, Rorschach, Switzerland.

A process for deoxidizing copper and its alloys, which consists in first adding a copper cartridge containing a phosphorus compound to the copper heated above its melting point, for the purpose of converting the impurities into phosphorus compounds, and then, when the copper has reached a higher temperature, adding a second copper cartridge filled with one of the metals of the alkaline earths, for the purpose of oxidizing the phosphorus compounds, the reaction being such that the phosphorus compounds burn at the expense of the alkaline earth metal, and the oxids being insoluble in copper, float on the top of the latter.

1,348,458. Aug. 3, 1920. **Process for Deoxidizing Aluminum and Its Alloys.** Albert Strasser, Rorschach, Switzerland.

A process for deoxidizing aluminum and its alloys, which consists in first adding an aluminum cartridge containing a phosphorus compound to the aluminum heated above its melting point, for the purpose of converting the impurities into phosphorus compounds, and then when the aluminum has reached a higher temperature, adding a second aluminum cartridge filled with one of the metals of the alkaline earths, for the purpose of oxidizing the phosphorus compounds, the reaction being such that the phosphorus compounds burn at the expense of the alkaline earth metal, and the oxides being insoluble in aluminum, float on the top of the latter.

1,348,470. Aug. 3, 1920. **Process of and Furnace for Refining Copper.** Frank L. Antisell, Perth Amboy, N. J.

The process of refining copper, which consists in continuously, progressively and serially preheating, roasting and melting copper forms separately and individually.

The process of refining copper which consists in continuously, progressively and serially roasting copper forms and then subjecting the said copper forms separately and individually to a melting temperature.

The process of refining copper which consists in gradually feeding copper forms to the melting zone where they are melted separately and individually and progressively and serially preheating and roasting said copper while being so fed.

The process of refining copper which consists in continuously, progressively and serially preheating and roasting copper forms and then subjecting the copper forms to a melting temperature so that they are melted separately and individually.

The process of refining copper which consists in continuously feeding copper forms to a melting zone, melting the copper forms in said zone and separately and individually, preheating and roasting the copper forms serially by a current of products of combustion passing counterwise to the direction of the feed.

1,348,478. Aug. 3, 1920. **Attachment for Metal-Coating Machines.** John A. Carrigan, New Castle, Pa.

In a device of the class described, the combination of a supporting means, pairs of feed-out rollers rotatably supported upon said supporting means, the rollers of each pair being contiguous to each other, while said pairs are spaced from each other, wiping rollers rotatably mounted upon said supporting means, said wiping rollers being interposed between pairs of the feed-out rollers, means for rotating the feed-out rollers at a uniform speed, and means for rotating the wiping rollers in the same direction as that of the feed-out rollers and slower than the feed-out rollers, thus causing a sheet of metal to positively pass out between the feed-out rollers and the wiping rollers.

In a device of the class described, the combination of a supporting means, pairs of feed-out rollers rotatably supported upon said supporting means, the rollers of each pair engaging each other under normal conditions, said pairs being spaced apart, wiping rollers rotatably supported upon said means and interposed between said feed-out rollers, meshing gears of uniform sizes connected to said feed-out rollers, enlarged gears connected to said wiping rollers, and gears so meshing with the gears of the feed-out rollers and wiping rollers, as to cause the wiping rollers to rotate in the same direction as the feed-out rollers, but at a reduced speed, thus causing the wiping rollers to have a slight dragging action upon a sheet of material moved outwardly between the feed-out rollers to evenly coat such material.

1,349,829. Aug. 17, 1920. **Pattern for Making Molds in Which Metals Are Cast.** William Gibson, Liverpool, England.

A pattern for making the molds in which fire bars or the like are cast, comprising a straight web having a head at each end projecting upward from the top of the web this part forming one of the units or elements of the pattern, and a plurality of interchangeable sections or lengths each having a straight groove at the underside adapted to embrace the top portion of the depending web and a continuous straight groove on the upper face.

1,349,918. Aug. 17, 1920. **Method for Producing Metallic Alloys Containing Nickel.** Michele N. Salvati, Turin, Italy; Guido Beer and Arrigo Tedesco, executors of said Michele N. Salvati, deceased, assignors to Societa Anonima Stabilimenti Biak, Turin, Italy, a company of Italy.

A method of manufacturing alloys containing nickel and zinc, consisting in first alloying together practically pure nickel and zinc and then adding the alloy thus obtained to the rest of the constituents of the final alloy.

1,350,166. Aug. 17, 1920. **Alloy.** Foster Milliken, Lawrence, N. Y., assignor to Foster Milliken, S. Fullerton Weaver, and James M. Repplier, trustees.

An alloy containing copper, nickel, iron, zinc and a purifying agent, the copper, nickel, iron and zinc being in a purified state and in proportion substantially as specified, the said purifying agent being a portion of 0.25 to 5 per cent. of the purifying agent used as the medium for purifying the said copper, nickel, iron and zinc, and remaining as an integral part of the alloy after purification of the said copper, nickel, iron and zinc, the said alloy being characterized by increased electrical resistance, increased elastic limit, increased tensile strength, increased density, a close and fine grain, and a high resistance to corrosion.

1,349,122. Aug. 10, 1920. **Die-Casting Apparatus.** Conrad Edlund, Brooklyn, N. Y., assignor to Doehler Die Casting Company, Brooklyn, N. Y., a corporation of New York.

In a die casting apparatus, the combination of a die having a plurality of segmental parts adapted to meet along longitudinal planes, said parts having jointly a die cavity extending lengthwise thereof, with undercuts, elongated members secured to said parts, respectively, arranged symmetrically at inclinations to the axis of the die, and means for moving said members in the directions of their lengths in opening and closing the die.

1,349,382. Aug. 10, 1920. **Method of Removing Lead from Copper Scrap.** Jesse L. Jones, Edgewood Park, Pa., assignor to Westinghouse Electric & Manufacturing Company a corporation of Pennsylvania.

The method of removing certain impurities from copper scrap which comprises melting the copper scrap, adding copper scale thereto to oxidize the impurities and separating the purified copper and the oxidized impurities.

1,349,416. Aug. 10, 1920. **Centrifugal Casting Method and Apparatus.** Harold Griffith Eynon, Philadelphia, Pa.

In a centrfugal casting machine, a casting drum and a heat conducting removable bushing therefore determining by the length and diameter of the bushing selected the length and diameter of the casting to be made.

1,350,359. Aug. 24, 1920. **Alloy.** Hugh S. Cooper, Cleveland, Ohio, assignor, by mesne assignments, to Zircon Tool & Alloy Corporation, a corporation of New York.

An alloy for high speed cutting tools containing a preponderating amount of nickel, zirconium one-half to two per cent., and an amount of aluminum and silicon at least double the amount of zirconium.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

NEW ELECTRIC HEATING APPARATUS

The exhibit of the General Electric Company at the New York Electrical Show provided an opportunity for the public to see a number of the most recent developments in the electrical industry, especially in industrial heating apparatus.

Among the various types of apparatus featured were a box-type japanning oven, furnished by Young Brothers' Company, of Detroit, and a heat-treating furnace, furnished by the George J. Hagen Company, of Pittsburgh.

The automatic temperature control panels and heating units in these two equipments were of General Electric Company manufacture. Some of the smaller devices that were more or less of the same class were a tool-room heat-treating muffle furnace, a self-regulating lead melting pot, water-jacketed and jacketless

GENERAL ELECTRIC COMPANY BOOTH AT THE NEW YORK ELECTRICAL SHOW.

glue pots, an immersion heater, and a number of various sizes of cartridge and helical coil heating units.

One of the impressive features of the display was the fact that the various furnaces, ovens, etc., were all in operation. This brought out, with a clearness that no amount of explanation could equal, the cleanliness, and quietness of electricity as applied to industrial heating. The fact that these devices could be operated in an exhibition room without filling the place with soot, fumes and noise, to say nothing of raising the temperature to an unpleasant degree, was conclusive proof of their advantage.

Further exhibits consisted of a 15 Kw. electric rivet heater which has been used considerably in shipyard, and other construction work and a single operator arc welding set, furnishing power for an automatic arc welding head. These two devices also were in operation and attracted considerable attention. A further exhibit of a different character was a battery charging set, such as is used in garages, etc.

NEW CLEANER

A new preparation known as "Meno" Rust Remover and Cleanser has recently made its appearance on the market, and it may be of considerable importance to all concerns and individuals engaged in or allied to any metal products industry. The inventor of the preparation is a chemist who, realizing that the methods employed to remove rust, corrosion, etc., from machines, engines, tools, parts and all metal surfaces, required considerable time and involved high labor costs, devised the "Meno" Rust Remover and Cleanser.

The name "Meno" is a word derived from the Latin and means "less work." It is claimed to be a combination and blending of certain chemical ingredients, which produce an electro-chemical action that rapidly loosens and dissolves rust, corrosion, grease, oil, dirt, carbon, paint or any other foreign substance that is adhering to the metal— irrespective of the age or hardness—and its action automatically ceases when contact between the cleanser and the metal is established. This, it is claimed, is as far as it will go, for it will positively not injure or mar the surface of the metal itself in any way.

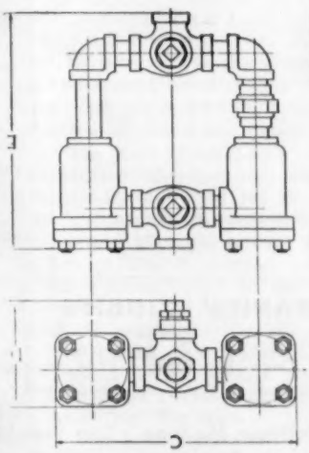
There are two methods of using the preparation as follows: (1) Apply it to the machine or part with a brush and allow it to remain for a short time, then brush or rub it off and it leaves the metal bright and clean. (2) Mix the preparation in a vat, tank or container with water, then attach the machine or parts to wire or chain so that they will hang in the solution. No further attention is required since the process of cleaning goes on while the parts are immersed. It is stated that the preparation is absolutely safe in every way and that it will not burn or explode.

Another important point claimed in its favor is that it will not cause corrosion or rust to form, for, in fact, it protects the metal and makes it exempt from corrosive or disintegrating action for a long period after it has been treated by this preparation, and there need be no fear of injury to the most delicate part, no matter what metal it is composed of. The preparation is an economical one to use, as the same solution may be used many times over as it does not deteriorate or lose its cleansing power. Peter A. Frasse & Company, of 417 Canal street, New York, are the sole distributors, and are now establishing agencies in various parts of the country for the sale of this preparation.

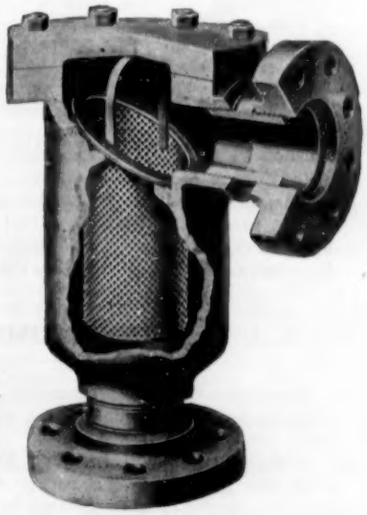
NEW OIL STRAINER

Strainers are required on the suction and discharge lines of lubricating oil, fuel oil and quenching oil systems, for the removal of solid foreign material in suspension. Also power plants which secure their raw water supply from such sources as rivers or lakes, require strainers to prevent weeds, sticks, marine plants and small fish from entering pipe lines.

For this purpose The Griscom-Russell Co., 90 West Street, New York, have placed on the market a G-R Strainer as



G-R STRAINER SET.



G-R STRAINER.

shown in accompanying illustration. The body is constructed of cast iron and the strainer basket of perforated sheet steel and lined with wire mesh when strainer is to be used on an oil line.

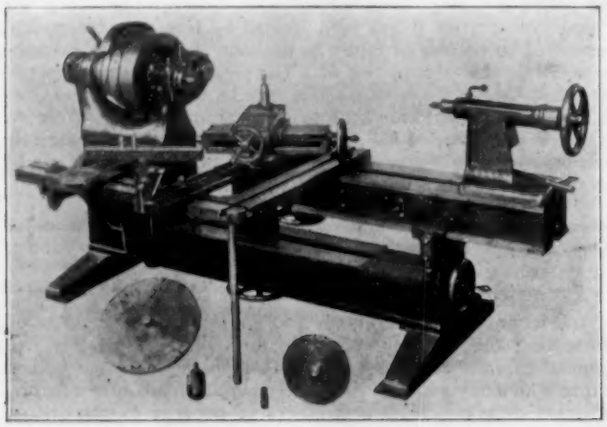
The G-R Strainer is of the single type and may be installed either as a single unit, or as the G-R Strainer Set. This G-R Strainer Set consists of two of these strainers connected, complete including two three-way valves and necessary connecting elbows, unions and nipples. This set permits the cleaning of either of the two units without interruption of the service. The manufacturers have published Form Sheet No. 168, describing this apparatus.

NEW SPINNING LATHE

This spinning lathe is built by the P. Pryibil Machine Company, 512 W. 41st street, New York, N. Y. Its use is for the spinning of large articles (copper utensils, etc.)

The machine has an extension bed and its members have box sections. The upper bed is supported by the main or lower bed. A cone pulley for belt drive is used; back gears are also added. The front spindle is made of a white metal, the rear, a thrust ball and radial bearing. Work varying from 27" in diameter to 60" in diameter can be handled by regulating the extension of the bed. The regulation is effected by sliding the upper bed along the lower, by means of a handwheel-operated screw at the right, and locking in place.

Faceplates, 12" or 20" are supplied; also belt-shifter and countershaft, if desired. Special chucks for oval or elliptical



NEW EXTENSION-BED SPINNING LATHE.

work can be provided. When heavy sheets are spun, compound-lever spinning tools are used.

The upper bed holds the tailstock, which is adjustable. Special tailstocks to be operated by hand can be rigged. The slide rests, as well as the tailstock, is mounted on the upper bed, but the spinning rest is supported by one end of the auxiliary bed, which is L-shaped and is itself supported by the lathe bed and a leg from the floor. There is also a T-rest, mounted so as to be adjustable, which has holes into which the spinning pins are inserted.

The machine is built so that the compound slide rest can be set in any position or swiveled; the tool is arranged for hand feed in two directions. The feed distances are 16" longitudinally and 9" across; the tool is ¾" x 1¼."

E. J. WOODISON COMPANIES' EXHIBITS

Woodison-Cappell Pneumatic Core Machine. This machine is designed to blow cores, such as pistons, manifolds and many other production jobs.

Woodison-Pattison Jolt and Rollover Machine. This machine has a jolt on one corner of the bench and a Rollover machine on the other. It can be used by two operators and will make cores up to 12 x 18 with a 5½" or 6" draw on dump boxes only.

Woodison-Pattison Ball Rollover Jolt Machine. This is a Ball Rollover Machine jolted by hand and will make the same cores as the Bench Jolt & Rollover Machine.

Woodison-Pattison Core Drawing Magnetic Machine. This machine is designed to use in connection with the Pneumatic Core Machine in drawing split boxes, or can be used where the work is rammed by hand.

Tepper Core Machine. This is used for drawing dump boxes, core being rammed by hand.

Woodison-Pattison Universal Sensitive Core Machine. Is used for drawing core boxes of the dump type.

Woodison-Swan Rollover Core Machine. This is extensively used for jacket cores and production work in general.

Woodison Core Jolt Machine and Bench. This machine is used for jolting cores of all description and does away with the ramming of the sand in the core box.

MOLDING MACHINE EXHIBIT

Woodison-Henderson Plain Jolt Machines.
Woodison Jolt Squeezers.
Woodison Plain Squeezers.

GENERAL SUPPLY

An exhibit of a full line of perforated Chaplets, Snap Flasks and Adjustable Jackets for snap flasks work.

Cupola Blocks, Fire Brick, Core Compound, Core Paste, Woodseed Liquid Compounds and Foundry Facings.

POLISHERS' AND PLATERS' SUPPLIES

Crystal Finish, Coloring Compositions, Tripoli, Emery Cake and Paste, Buffs, Wheels and a general line of Polishers' and Platers' Supplies.

An interesting model of their Detroit plant was on exhibit. It is supposedly the most up-to-date plant in the country for the manufacture of the various commodities sold by them, which includes Facing Mill, Oil Cooking plant, Buffing Composition, Parting and Core Compound Departments also, Snap Flasks, Perforated Chaplets, Skim Gates, Wax Vent, Molding and Core Machines, Tongs, Shanks and Brass Furnaces, manufacturing departments. Pictures of their various branches, including their branch managers, were conspicuously hanging adjacent to the model plant.

HOW SOME OTHERS LOOKED AT THE COLUMBUS CONVENTION

WHITE & BRO., INC., BOOTH

JOSEPH DIXON CRUCIBLE CO., BOOTH

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

BOSTON BRANCH A. E. S.

Meetings were held Friday, October 1 and October 15, at Quincy House, President Francis Mackie in the chair.

One application for active membership was received and referred to the board of trustees. Two applicants for active membership were elected.

After the regular order of business a very interesting discussion was held for over two hours on the pitting of nickel work. A few of the answers were:

1. Hydrogen going to the cathode by the use of too much acid is one reason for pitting, and to overcome this ammonia will neutralize the solution.
2. Too much current will also cause pitting.

After the regular order of business a motion was carried that a committee be appointed to arrange for a banquet to be held in February. The committee appointed by the chair was made up of Mr. Herrick, Mr. Nihan and Mr. Gale.

Mr. Herrick gave a very interesting talk on lacquer troubles, which were discussed by all the members for more than two hours.

The Boston branch is open to membership at any time, and some very good talks are on the bill for the winter. By the last of the winter we expect to have our own laboratory, where we can work out our problems, and all the members will learn a great deal of chemistry.

PROVIDENCE-ATTLEBORO BRANCH

The fourth annual banquet of the Providence-Attleboro Branch, A. E. S. will be held in Providence at Narragansett Hotel, Saturday night, December 11, 1920. They are striving to have as many manufacturers or their representatives attend this event as possible. An interesting program has been arranged and suitable speakers will talk upon the objects of Society. All members of the A. E. S. who are in Providence or vicinity on the night of the banquet will receive a hearty welcome. Tickets for banquet are $3.50.

BRITISH INSTITUTE OF METALS

SESSION 1920-21

March 9, 1921.—Annual general meeting, 10.30 a. m., Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.I. Annual dinner.

March 10, 1921.—Annual general meeting, 10.30 a. m., Institution of Mechanical Engineers.

May 4, 1921.—Annual May lecture, 8 p. m., by Prof. T. Turner, M.Sc., A.R.S.M., Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.I.

September, 1921.—Annual Autumn meeting.

Full particulars of the above meetings will be sent to all members in due course.

The next ballot for the election of members and students will take place on December 15, 1920, and there will be other ballots on February 23 and April 20, 1921.

BIRMINGHAM LOCAL SECTION

PROGRAMME.

October 12, 1920.—H. W. Brownsdon, M.Sc., Ph.D. Chairman's address.

November 16, 1920.—Discussion upon "Hardness in Non-ferrous Alloys."

December 14, 1920.—W. R. Barclay, O.B.E. "Some War Experience in the Electro-deposition of Metals."

January 11, 1921.—Ernest A. Smith, A.R.S.M. "Segregation in Non-ferrous Alloys."

February 15, 1921.—O. F. Hudson, D.Sc. "Bearing Metals."

March 22, 1921.—R. T. Rolfe. "Gun Metal."

April, 1921.—Annual general meeting.

The meetings are held in the Imperial Hotel, Temple street, at 9.30 p. m.

SCOTTISH LOCAL SECTION

PROGRAMME.

October 27, 1920.—The Rt. Hon. Lord Weir, of Eastwood, P.C. (member of Council). Address on "Some Notes on Foundries and Production."

November 9, 1920.—J. A. C. Edmiston. "Fuel."

December 14, 1920.—Discussion on "Furnaces" (to be opened by Messrs. J. Stirling and J. Arnott).

January 11, 1921.—S. E. Flack, "Rolling and Extrusion."

February 8, 1921.—G. H. Bailey, D.Sc., Ph.D. "Aluminum, Production and Uses."

March 8, 1921.—Annual general meeting. Address by James Steven (vice-chairman local section).

The meetings are held in the rooms of the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, at 8 p. m.

SHEFFIELD LOCAL SECTION

PROGRAMME.

October 15, 1920.—Ernest A. Smith, A.R.S.M. "The Development of Non-ferrous Research." (Chairman's address.)

November 19, 1920.—"Electroplating." (Conjoint meeting with the Faraday Society).

December 17, 1920.—J. Kent Smith, O.B.E. "Some Alloys in the Foundry."

January 28, 1921.—Prof. C. H. Desch, D.Sc., Ph.D. "60:40 Brass."

February 18, 1921.—"F. Rogers, D.Eng., B.A., M.Sc. "Cracking in Worker Brass and other Metals."

March 18, 1921.—W. Rosenhain, D.Sc., F.R.S. (vice-president). "The Crystal Boundary."

April 15, 1921.—H. A. Greaves, "A New Non-ferrous Electric Furnace."

The meetings are held in the Mappin Hall of the University of Sheffield, St. George's Square, at 7:30 p. m. Membership of the section is free to all local members of the Institute, who should apply for membership to the honorary secretary, Mr. Sidery.

FEDERATED ENGINEERING SOCIETIES

The Joint Conference Committee takes pleasure in announcing additional members of The Federated American Engineering Societies:

Kansas Engineering Society.—The Kansas Engineering Society, by letter ballot, has voted to become a charter member of The Federated American Engineering Societies and has named Lloyd B. Smith as the delegate to represent the society at the first meeting of American Engineering Council on November 18-19, 1920.

Alabama Technical Council.—The Alabama Technical Council at its regular meeting on October 1, 1920, voted to become a charter member of The Federated American Engineering Societies.

The Joint Conference Committee also takes pleasure in announcing the following:

The Board of Directors of the American Institute of Electrical Engineers at its meeting on October 8, 1920, appointed the following representatives of the Institute on American Engineering Council:

*Comfort A. Adams, Cambridge, Mass.; A. W. Berresford, Milwaukee, Wis.; *H. W. Buck, New York, N. Y.; F. L. Hutchinson, New York, N. Y.; W. A. Layman, St. Louis, Mo.; William McClellan, Philadelphia, Pa.; L. F. Morehouse, New York, N. Y.; L. T. Robinson, Schenectady, N. Y.; *Charles S. Ruffner, New York, N. Y.; L. B. Stillwell, New York, N. Y.; *Calvert Townley, New York, N. Y.

The Florida Engineering Society has appointed L. R. McLain to represent it at the first meeting of American Engineering Council, November 18 and 19, 1920.

*Members of Engineering Council of Founder Societies.

MEMBERS OF THE FEDERATED AMERICAN ENGINEERING SOCIETIES

Alabama Technical Association,
Birmingham, Ala.
American Institute of Chemical Engineers,
Brooklyn, N. Y.
American Institute of Electrical Engineers,
New York, N. Y.
American Institute of Mining & Metallurgical Engineers,
New York, N. Y.
American Society of Agricultural Engineers,
Ames, Iowa.
American Society of Mechanical Engineers,
New York, N. Y.
Detroit Engineering Society,
Detroit, Mich.
Engineering Association of Nashville,
Nashville, Tenn.
Engineering Society of Buffalo,
Buffalo, N. Y.
*Florida Engineering Society,
Gainesville, Fla.
Kansas Engineering Society,
Topeka, Kan.
Technical Club of Dallas,
Dallas, Texas.
The Cleveland Engineering Society,
Cleveland, Ohio.
The Society of Industrial Engineers,
Baltimore, Md.

*Subject to ratification at the annual meeting in February, 1920.

The aggregate membership of the above organizations is 37,233, and they are entitled to 43 representatives on American Engineering Council.

The Engineering Society of York at its meeting on October 18, 1920, unanimously adopted the following resolutions:

"Whereas there has been organized an association known as 'The Federated American Engineering Societies,' whose aims and objects have been endorsed by most of the leading engineering bodies, and

"Whereas the said objects are in full accord with our constitutional objectives;

"Be It Resolved, That we, the Engineering Society of York, Pennsylvania, apply for Charter-Membership in said organization and thereby lend our strength and aid to the work of furthering the interest of the profession through this valuable agency."

The Washington (D. C.) Society of Engineers at its meeting on October 20, 1920, voted to become a Charter-Member of The Federated American Engineering Societies.

Mr. D. J. Sterrett has been appointed a delegate to represent the Detroit Engineering Society at the first meeting of American Engineering Council to be held in Washington, D. C., November 18-19, 1920.

The Buffalo Engineering Society has appointed President W. B. Powell a delegate to the first meeting of American Engineering Council.

AMERICAN WELDING SOCIETY

Members of the welding trade in Cleveland expect to hold an organization meeting possibly the 29th or 30th of September.

The secretary would be glad to have suggestions from members regarding speakers for our regular monthly meetings. What subject would interest you?

The programme for the October meeting (October 12) will be issued shortly.

The Executive Committee of the American Welding Society (New York) has recommended that a New York Section be formed to operate separately from the parent organization.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

Bertram A. Stone, formerly of Bloomfield, N. J., has taken a position as foreman of the polishing and plating departments of the Richmond Pressed Metal Works, South Richmond, Va.

J. A. Janney, formerly a sales executive for the Western Electric Company, with offices in Chicago, has begun his duties as field sales manager for the Torrington Company, National Sweeper Division.

Ralph E. Wilcox, of New Hartford, formerly with the **Hendey Machine** plant here, has begun his duties as instructor in the pattern-making department of the state trade school in Torrington. He succeeds **George W. Butler.**

William T. Stewart announces that he is no longer connected with the Unique Brass Foundry Company, Buffalo, N. Y., and extends his thanks to his friends in the trade for their patronage and good fellowship which helped towards his success in the past fourteen years.

A. Stephen Knowles announces the opening of an office at 66 Broadway, New York City, to do general consulting work in coal and its by-products, specializing in testing coal for coking properties, preparing reports on plants and processes, and designing, constructing and operating by-product ovens.

Clifford W. Post, who went to England a year ago to assume his duties as general manager of the Torrington Company's plant at Coventry, spent September in town. He was accompanied by his wife. **Mr. Post** was formerly in charge of the latch needle department of the **Excelsior Needle** plant.

Frederick L. Braman, vice-president of the **American Brass Company,** has been re-elected a representative from Torrington to the state legislature. The other representative is **Thomas J. Wall,** who succeeds **Charles H. Alvord,** of the **Hendey Machine Company. Mr. Alvord** declined to again be a candidate.

Harold Brookman, for many years assistant superintendent of the brass shop of the **Jordan L. Mott Company,** was recently honored by fellow employees, who presented him with a gold watch and chain on the occasion of his resignation to engage in business in New York State. He will now be located at Canajoharie, N. Y.

Seneca Lodge, 55, F. & A. M., Torrington, Conn., last month held a special communication and banquet in honor or eleven of its members who have completed fifty years in Masonry. Among the eleven are **Charles F. Brooker,** president of the **American Brass Company,** who was made a Mason on April 30, 1868; **Luther G. Turner,** of the **Turner & Seymour Company,** July 21, 1868; **Frederick F. Fuessenich,** of the **Hendey Machine Company,** April 26, 1870.

W. C. Langenau, president of the **Langenau Manufacturing Company,** who died at Mt. Clemens, Mich., was buried here early in September. Mr. Langenau was 71 years old. He was born in Germany, came to this country when 17, and started work in Cleveland as a laborer. Later he became a locksmith, and from this he finally came to establish the company that bears his name, and which has since become one of the leading hardware specialty producers of the country.

Richard Sheldrick has resigned as secretary, director and sales manager of The Kalbfleish Corporation, after a connection of fifteen years' duration, and has associated himself with D. S. Himadi as vice-president of D. A. Himadi & Company, Inc., at 51-53 Maiden Lane, this city, of which firm Mr. Himadi is president. Mr. Himadi has been in the chemical business for a number of years and is the president of the Lodi Trust Company of Lodi, N. J. For the present the company plans to do a general chemical business as jobbers and manufacturers' agents with offices at the Maiden Lane address and Lodi. C. L. Hutzelman, well known in plating circles, has also allied himself with this firm as salesman in Greater New York.

DEATHS

ARTHUR HAUCK

Arthur Hauck, president of the Hauck Manufacturing Company, manufacturers of oil burners, died at his home, 1890 Ditmas avenue, Brooklyn, on Saturday, aged 40 years.

SAMUEL TSCHOPP

Samuel Tschopp, 70 years of age, foreman of the brass foundry department of the Louisville & Nashville Railroad Company shops, and one of the oldest shopmen the company had, dropped dead of heart disease shortly after reaching his office on October 28, 1920. Mr. Tschopp had been with the company more than fifty years, helping it to operate a big local brass shop, making journals for cars, and other equipment, the main shops being at Louisville.

FRANK B. NOBLE

Frank B. Noble, who died at his home in Watertown on July 2, 1920, was, up to the time of his death, secretary of the Chase companies for a number of years. He was 55 years old and his connection with the Chase companies extended over a period of 35 years. He had been a resident of Watertown all his life, attending the public schools there. Later he studied at the Waterbury High School.

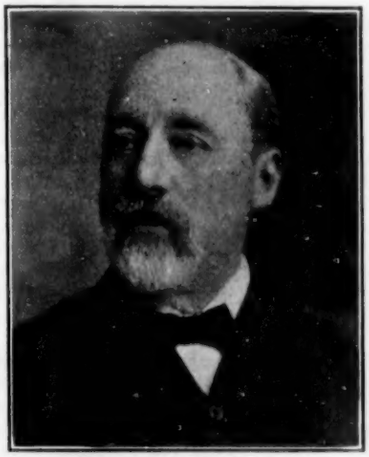
Mr. Noble always took an active interest in his native town, and was usually foremost in all projects having for their object the betterment of his birthplace. He was president of the Watertown library, treasurer of the Episcopal church, trustee of the cemetery association and a member of the Civic Improvement League. He is survived by two daughters and a son, all of Watertown.

WILLIAM H. MIXER

William H. Mixer, vice-president of the United American Metals Corporation of Brooklyn, died at his home in California early in September, 1920. He joined the Syracuse Smelting Works 25 years ago when that company was in its infancy. He was then salesman for the far west, known in almost every lumber camp and every mine in the west and northwest. For the last fifteen years he has held the office of vice-president of the company. In 1917, when the United American Metals Corporation absorbed the Syracuse Smelting Works, he was elected vice-president and director, holding that position until his death. He was recognized in the babbitt industry as one of the best posted men in the country on bearing metals. During the past year he spent most of his time on his estate in Berkeley, Cal. He was 64 years of age.

ALFRED JOHN SHIPLEY

Alfred John Shipley, for 35 years master mechanic in the button department of the Scovill Manufacturing Company, died at his home in Waterbury on September 16, after a month's illness. He was born in Waterbury, January 1, 1840. When he was 10 years old his parents moved to Newark, N. J., where he attended for a time the Newark Institute. At an early age he began working with his father, learning the machinist and toolmaker trade, and in 1857 went to Albany to set up machinery which his father had built for a harness making firm in that city. He returned to Waterbury in 1858 and in 1862 entered the employ of the Scovill company. In 1864 he became master mechanic of the button department, a position he held until his retirement in 1899. During this time he took out 11 United States patents for buttons and button machinery, and made many improvements on tools and machinery for button making.



ALFRED JOHN SHIPLEY

Mr. Shipley was a man who was greatly loved and respected by all who were associated with him in his work, in Masonic circles, in the church and in family life.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

NOVEMBER 1, 1920.

Within three months after the ending of a gruelling 11 weeks' strike of the Waterbury brass workers for higher wages and shorter hours, the **Scovill Manufacturing Company,** one of the largest in the city, announced the cutting of the working week to five days because of lack of work. Simultaneously the **American Brass Company** and the **Chase Companies** also went on the five-day schedule.

A week later the announcement of a flat 10 per cent. cut in wages was announced by the **Scovill Company,** to take effect beginning November 7. To date the **Scovill Company** is the only one of the three large brass concerns which has announced a reduction in wages.

Officials in all the plants stated that it was not certain that the five-day schedule would be maintained every week. The five-day schedule was adopted rather than resort to extensive lay-offs. A gradual letting up in business has been noticed in all the factories, and as a result there has been a corresponding cutting down and weeding out of unnecessary labor. About 100 ordinary laborers have been laid off at the **Scovill** plants, with lesser numbers at the Chase and American Brass plants.

Whether the business depression is due to the presidential elections is a matter of conjecture. Officials in some of the plants admitted a slight falling off in orders, but another reason advanced is that automobile concerns are eliminating much of the construction in automobiles which call for brass fittings.

The price of copper, an important raw material in the manufacture of brass, has fallen off considerably, and the expectation of lower prices all along the line is said to be largely responsible for the cautious attitude of the brass manufacturers.

The 10 per cent. reduction by the **Scovill** company puts the schedule of wages back to nearly what it was a year ago last June. At that time, following a short strike, salaried employees were given a percentage increase and hour workers were given a 10 per cent increase and time and one-half over eight hours. The departments continued to work ten hours a day as formerly, so that the men received 11 hours' pay for 10 hours' work. Now they will receive straight time for 10 hours' work.

John H. Goss, general superintendent of the Scovill Company, stated that while there have been indications of a depression in the city's manufactories for some time, the actual depression came suddenly. It began with the receipt of letters from purchasers cancelling orders. In commenting on the wage reduction, he said:

"The reduction in wages is one of the things which almost breaks our hearts, but which we can't help. In a time of depression business has got to conserve its resources. With no business coming in to amount to anything, and with shipments greatly exceeding orders, the future does not look very encouraging. And we have got to cut our prices before we can get new business, which means a cut somewhere in the cost of manufacture.

"It will be noticed that the reduction is not stated as a permanent thing, but until further notice. If future conditions warrant a change for the better, a change can and will be made. And if business picks up for some reason or other after the election, a change in the present announcement might be made."

President **John A. Coe,** of the **American Brass Company,** stated recently that there would be no reductions in wages at their plants, although it might prove necessary to curtail the number of working hours per week. A similar statement was made by **John A. Neagle,** of the **Chase Companies.**

Information, or rather the lack of information, regarding the coal situation in Waterbury leads to the conclusion that Waterbury will not be seriously affected by a shortage of coal this winter. Coal for household use is scarce at the present writing, but from what can be learned local manufacturers have, in the aggregate, made satisfactory arrangements for their winter's supply of coal.

That Waterbury is becoming more and more recognized as the brass center of the world is instanced by a recent request to the secretary of the chamber of commerce from two large publishers of geographies for special articles on the history, growth and products of the city, with especial reference to the manufacture of brass.

Much as insurance "grows up" as a part of the Hartford boy, in the same manner inhabitants of Waterbury are becoming, to an ever increasing extent, identified with brass.

Recently three Waterbury high school boys carried away highest honors in the junior achievement village at the Eastern States Exposition at Springfield, Mass., at which cities from all over New England were represented. The prize was in the grand championship, or sweepstake class,

MYRON MILLER, WILLIAM CEDARHOLM, GAETANO SANDULLI.
These boys won prizes at the Eastern States Exposition, Springfield, Mass., with a Brass Exhibit.

and was for the best all round team demonstration in any project in the village. The boys also won first prize for the best booth exhibit and second prize for the best team demonstration of the production, selling and use of a single product. Their topic, naturally, was brass. In addition to carrying off a large share of the prizes, the boys received an offer from one of the judges, a Chicago man, to tour the west on a demonstration trip similar to the one which they gave at the exposition. The names of the boys are **Myron Miller, William Cedarholm** and **Gaetano Sandulli,** 17, 19 and 18 years old, respectively.

NEW BRITAIN, CONN.

NOVEMBER 1, 1920.

A business reaction that is being felt keenly, though not as yet with panicky effects, caused by industrial depression all over the country, coupled with the tightness in the money market and the presidential election, is sweeping over the metal manufacturing industries of New Britain and vicinity. Already hundreds of employees who for the past two or three years have been working at high wages have been either discharged or laid off, and today, in contrast to times a year or so ago, there are long lines of employment seekers in front of the employment bureaus of the several factories.

The reaction from the boom of war time was first felt at the **New Britain Machine Company,** which also was one of the first concerns to be blessed with government orders. These, however, have proved far from a blessing and the concern, it is said, made but little, if any, profit on the government and sacrificed much of its regular business. When the New Britain Tractor, a product of this concern, was put on the market it was hoped that it would turn the tide of events. Unfortunately, the boom did not materialize, and although the tractor is not a failure, it has not resulted in any boom. Business is slow with the tractors, officials say, because this is the "between season" period. The production of tractors will probably go slowly for several months, **Secretary R. S. Brown** declares. It is estimated that upwards of 500 or 600 have either been let go or temporarily laid off at the Machine Company, and the factory is now on a 45-hour week.

Although all of the factories are not so seriously affected, the fact remains that in none of them are conditions as they were. However, the depleted conditions of the stockrooms assures steady employment for the workers for several months. At the **Stanley Rule & Level Company** it is said that although orders are falling off noticeably, nevertheless in the line of bit braces alone the stock is so far depleted that it will take eight months to fill the shelves again. **Landers, Frary & Clark** are now occupying a new addition recently built and while some departments are not rushed, others, those dealing especially in the domestic hardware and electrical goods, are doing a good business. The **North & Judd Manufacturing Company** gives out a very optimistic report. Business there is really good and an effort has to be made to keep abreast of orders, it is said.

Leaders in the local industries do not attempt to hide the fact that business is slumping, but they attribute it to a general decline in trade due to high prices, the unwillingness of banking houses to issue big loans and a pre-election condition brought about by inattention to work. In every instance they predict that following the November elections business will pick up.—H. R. J.

TORRINGTON, CONN.

NOVEMBER 1, 1920.

Reductions in orders have made it necessary for several of the largest plants here to cut down their working forces. The plants are also operating on shorter schedules, some departments working only four days a week.

Landers, Frary & Clark, of New Britain, will operate the factories of the Greenwoods Company in New Hartford, this county. About 1,000 hands will be employed. In order to encourage the company to locate in New Hartford the town voted to exempt the property from any increase in taxes during the next ten years.

The Thomaston Metal Products Company capitalized at $72,500, has leased the old plant of the **American Knife Company** in Reynolds Bridge, this county.

The Volk Manufacturing Company has purchased the Flynn & Doyle building in Bantam, this county, and will engage in the manufacture of renewable fuses. The company is capitalized at $150,000.

The Torrington Factory League baseball championship for 1920 was won by the **Coe Brass** team of the **American Brass Company. Patrick Smedick** was manager.

INDIANAPOLIS, IND.

NOVEMBER 1, 1920.

The first step toward the start of extension work in Indiana industries, similar to that done for the farmers of the state by Purdue University, was taken recently by representatives of Indianapolis manufacturers and university men at a dinner and meeting at the Chamber of Commerce.

Dr. W. E. Stone, president of Purdue; **Dr. A. A. Potter,** dean of the school of engineering, and **George H. Shepard,** head of the industrial engineering and management department, and the instructor of the course to be given here, spoke on the needs of extension work and the ways in which the university could co-operate with the manufacturers. Arrangements were made for the first course, a training school for the foremen, which will be established here.

Dr. Stone spoke of the ways in which agriculture in the state has been aided by the combination of teaching, research and extension work, and he stated that all that has been accomplished for agriculture is possible for the other industries of the state. The engineering schools have been brought to a high standard of instruction, **Dr. Stone** asserted, scientific research was inaugurated by the establishment of the engineering experiment station three years ago, and now Purdue plans to complete the program by establishing extension schools for manufacturers.

The course will cover thirty-one periods, and will be divided under the following heads: "Setting Shop Standards," "The Relation of Product to Plant Efficiency," "Plant Layout," "Shop Planning and Dispatching, or the Routing of Work," "Cost Systems," "Organization," "Fair Deal," "Development of Morale," "Handling Men," "Improvement of Methods," "Incentive System of Wage Payments."

Stanley Zweibel, of the **Nordyke & Marmon Company,** read letters concerning the work in Wisconsin and Pennsylvania. A discussion followed. **W. D. Oakes** was in charge of the meeting.

Averments that the **Indiana Railways and Light Company,** Kokomo, is not losing money in its electric power department supplying the **Haynes Automobile Company,** the **Kokomo Rubber Company** and the **Kokomo Brass Company,** are contained in a protest the companies filed with the public service commission against the I. R. & L. increase rate petition. The companies assert that the light company does not allocate properly its costs and disbursements, and that the result is seeming losses in a department that should not show losses. The companies advise against the increasing of their own production costs at a time like the present.

NEWARK, N. J.

NOVEMBER 1, 1920.

Foundrymen of Newark who manufacture brass, bronze and aluminum goods, report that they have plenty of advance orders on file to keep them busy during the fall season. Some of them assert that there has been a let-up in the pressing demand for materials that was experienced in the spring and last winter, when capacity production was insufficient to meet the demand. They are working under more normal conditions and do not have to resort to overtime to accommodate their customers. Managers of foundries declare the present situation brings better shop conditions. Moulders and others are not complaining of too long hours, they say, and the general shop atmosphere is made healthier by the absence of restlessness.

F. & H. Foundry, Inc., of 207 Berkeley avenue, is building another plant in the Forest Hill section of the city. The present foundry one-story building, 50 x 100, is too small for the work ahead, and three acres near the Tiffany Boulevard were purchased. The new foundry structure will be a one-story brick, 50 x 160. It will cost $30,000. In addition the company plans to build a two-story office building on the site, the cost of which has not been estimated. Officials say they have enough advance orders for their specialty, bronze bearings for rolling mills, to keep them busy for many months.

Having many orders for aluminum receptacles for the boiling of hams, the **American Foundry Company, Inc.,** at 634 South Eleventh street, is specializing on this production. The provision men are said to have found that the separate aluminum boiler for each ham was the best method of treating the meat and have placed large orders for them. The receptacles are designed as well as manufactured at the South Eleventh street plant.

George H. Harman, Inc., Newark, N. J., was incorporated, with 25,500 shares of stock, to engage in the manufacture of metal specialties. The incorporators are: **George H. Harman, Russel Fleming** and **James L. Handford,** of 790 Broad street, Newark, N. J.

The plant of the **Eagle Iron & Brass Foundry** at Passaic, N. J., was recently badly damaged by fire.

The American Can Company, with general offices at 120 Broadway, New York, is having plans drawn for a plant at Newark, N. J., to cost about $500,000.

Daylight Lamp Works, Inc., of West New York, N. J., has been incorporated at Trenton, N. J., with a capital stock of $25,000, to manufacture and deal in auto lamps, etc. The incorporators are **Samuel Pollock, Sadie Englowitz** and **Tillie Ungerer,** all of West New York, N. J.

American Metal Bed Company, 8-10 Branford street, Newark, N. J., has taken out a permit for a one-story steel shed, 40 x 75 feet, and will use the same for storage purposes.

Atlantic Smelting Company, 415 Doremus avenue, Newark, N. J., will erect a brick and hollow tile garage, 30 x 80 feet, to cost $4,500.

The Harry Bentz Engineering Company, of New York City, has leased a building at 532 Mulberry street, Newark, N. J., which it will utilize for the manufacture of various kinds of metalware.

The National Anode Company, of Garfield, N. J., will erect a foundry at that place, to cost $12,000.

Newark Pattern Engraving Company, Newark, N. J., will make a number of alterations to the plant at 112-14 Wickliffe street, Newark, N. J.

TRENTON, N. J.

NOVEMBER 1, 1920.

The Hulslander Engraving and Stationery Company, Trenton, N. J., has purchased a plot of land on Lincoln avenue, 100 by 100 feet, and will erect a modern plant, with up-to-date facilities for the manufacture of articles used in the engraving business. The concern, which does practically all the work for the automobile tire manufacturing companies of Trenton, has outgrown its present quarters on North Stockton street. The concern handles considerable copper and brass.

Eight men have been sentenced by **Vice Chancellor Buchanan,** at Trenton, N. J., to serve three months in the Mercer county jail and pay a fine of $50 each, on the charge of having violated an order of the Court of Chancery directing them to stop picketing the plant of the **Bijur Motor Appliance Corporation,** of Hoboken, N. J. The company offered photographs as testimony, showing the pickets carrying placards advertising a strike at the plant. The vice chancellor gave the men an opportunity to explain their actions, but the strikers offered no defense. The men were forbidden by the court to hang around the plant. The Bijur company manufactures brass spark plugs.

Vice Chancellor Backes has handed down a decision enjoining a proposed systematic strike to prevent completion of a contract between the **Lehigh Structural Steel Company** and the **Atlantic Smelting and Refining Company** for the structural steel work for a part of the refining plant at Newark, N. J. The essence of the decision is a declaration of the court against the use of the strike as a means of preventing the "open shop" method or the use of non-union labor, on the ground that the underlying purpose of such a strike is to create a monopoly of labor, thereby infringing the rights of employers and of workers who are not members of labor unions.

Eastern Electric Supply Company has leased for a number of years a double store building on Plane street, running to Academy street, Newark, N. J. The structure is three stories. The company is one of the largest jobbers in electrical merchandise in New Jersey.

The Prior Chemical Corporation, of Rutherford, N. J., has purchased six acres of land at Fairmont and Henry streets, Elizabeth, N. J., and will erect a modern chemical plant. The company has also purchased three acres of land of the Maurer estate, with the prospect of enlarging the plant in due time. The concern owns twenty-two acres of land at Dover, N. J., where its mines are located and where metal experiments are perfected.

The McGarry-Norton Company, of East Orange, N. J., has been incorporated at Trenton, N. J., with $125,000 capital stock, to manufacture steam and water fittings. The incorporators are: **P. J. McGarry, John J. Norton** and **Cornelius Shea.**

The Automatic Safety Signal Company, of Jersey City, N. J., has been incorporated at Trenton, N. J., with $25,000 capital stock, to manufacture safety signals, etc. The incorporators are: **J. J. McCarthy, N. L. Paladeau** and **J. G. Flanigan,** all of Jersey City.

The Morris Specialty Manufacturing Company, of Morris Plains, N. J., has been incorporated at Trenton, N. J., with $50,000 capital stock, to operate as metal platers, etc. **R. R. Hutchinson**, of Maplewood, N. J., **A. A. Dudley,** of Morristown, N. J., and **W. W. Arrowsmith,** of Brooklyn, N. Y., are the incorporators.

Union Bronze Company, of Bayonne, N. J., has been incorporated at Trenton, N. J., with $2,000 capital stock to operate a foundry. The incorporators are: **C. D. Ward** and **J. E. Quigley,** of Bayonne, N. J., and **J. E. Bolger,** of Jersey City, N. J.

International Brass and Copper Company, Inc., of Newark, N. J., has been incorporated at Trenton, N. J., to deal in brass and copper products. The capital stock of the new company is composed of 50,000 shares of preferred and 50,000 shares of common stock. The incorporators are: **Irving Eisenberg, M. A. Potter** and **E. T. Adam,** all of Newark, N. J.

Essex Blade and Supply Company, of East Orange, N. J., has been incorporated at Trenton, N. J., with $50,000 capital stock to manufacture safety razor blades and novelties. The incorporators are: **Stanley L. Gedney, Jr., Charles O. Geyer** and **F. E. Lynch,** all of East Orange, N. J.

The Balbach Smelting and Refining Company, Newark, N. J., is making a mumber of alterations to its laboratory on Wilson avenue.

The Arrow Signal Manufacturing Corporation, of Trenton, N. J., has been incorporated with $200,000 capital, to manufacture automobile accessories of every description. **C. C. Rose,** of 227 East Front street, Trenton, N. J., is the agent in charge. The new company will erect a plant later to manufacture its goods.

Callaphont Company, of New Jersey, of Newark, N. J., has been incorporated at Trenton, with $250,000 capital, to manufacture instruments. **J. P. Andrews, T. O. Peterson** and **J. H. Osman,** all of Newark, are the incorporators.

The Lyons Electric Appliance Company, of Bridgeton, N. J., has been incorporated, with $100,000 capital stock, by **John P. Lyons, R. E. Shoemaker,** and **Frank R. Bacon,** to manufacture electrical appliances, etc.

The Ingersoll-Trenton Watch Company had an attractive exhibit at the recent Trenton fair. **The Jonathan Bartley Crucible Company** also had a booth at the fair and demonstrated how its wares are made. The space for the manufacturers was offered gratis by the fair association.

The Union Smelting and Refining Company, of Newark, N. J., has postponed the proposed building operations adjacent to its plant on Charles street because of the general business conditions. The plans and blueprints for the proposed improvements will be preserved by the company until conditions improve.

The Scott & Bowne Company, manufacturers of chemicals, and the **Westinghouse Lamp Company,** contemplate erecting additions to the plants at Bloomfield, N. J.

The H. and F. Brass Foundry, Tiffany Park, Newark, N. J., has taken out a permit for the erection of a one-story brick foundry, 42 by 120 feet and 26 by 40 feet, to cost $16,000.

Fernando C. Mesa Company, 810 Broad street, Newark, N. J., has been incorporated, with $1,500,000 capital stock, for the purpose of manufacturing porcelain electrical wiring devices and supplies. **Roy J. Harding, James Mango** and **Joseph Price** are the incorporators.

Herford Company, of the Township of North Bergen, N. J., has been incorporated at Trenton, with $125,000 capital, to deal in hardware. The incorporators are: **Louis F. Beachner, John J. Fallon, Jr.,** and **J. Harry O'Brien,** all of Hoboken, N. J.

ROCHESTER, N. Y.

NOVEMBER 1, 1920.

As is usual in presidential years, activity in industrial lines has slowed down in Rochester as in other cities throughout the country. By this it must not be inferred that Rochester manufacturing institutions are suffering from a condition that cannot be accounted for otherwise, for it is a fact that every fall during a presidential canvass business is more or less affected.

Among the industries using metals in Rochester there is not that feeling of uncertainty that is said to exist in many cities with regard to the shortage of orders and a certain percentage of cancellation. In fact, it is said that no Rochester plant has been affected by cancellation of orders in several years.

There is a pronounced let down in many industries throughout the city, however, although such a situation is not apparent in the plants of the **Eastman Kodak Company** or the **Bausch & Lomb Company.** The big plants in Lincoln Park, including the **Pfaudler Manufacturing Company** and the **General Railway Signal Company,** are apparently operating with full-time forces.

The **Eastman Company** continues to widen and broaden out in its tremendous activity. More land has been acquired for building purposes near the main plant at Kodak Park, and several large blocks of buildings near the State street camera works have been purchased by the corporation. These large structures will soon be vacated and occupied by overcrowded kodak departments in State and Platt streets.

Owing to the rather unsettled state in the building trades, several new concerns that will prove to be large users of metals have deferred the erection of shops and warerooms until next spring.

A feeling of cheer prevails in all manufacturing circles because of the gradual betterment of shipping facilities on all rail lines entering Rochester. Purchasing agents say the reported negotiations between the **Buffalo, Rochester & Pittsburgh** and the **Delaware, Lackawanna & Western Railroads,** which may result in Lackawanna trains entering this city over the tracks of the former, will be a valuable addition to the city's shipping routes. Both freight and express shipping conditions have greatly improved during the fall.

There is little or no change in the market here for copper and brass, and values are unchanged. Supplies of both metals are readily obtainable and local warehouses are said to be well stocked. There is no demand for lead in Rochester, that is, beyond the nominal sort. Tin is quiet and in fairly good supply.

ROME, N. Y.

NOVEMBER 1, 1920.

Business in the metal industry plants of this city during the past month has experienced a slight slump, owing to depressing market conditions. However, the finest spirit of co-operation prevails all around, and there never has been a time in the history of the industry in this city when more wholesome relations existed between workmen and employers.

Baseball furnished the main recreational sport here during the past summer. Through the support and assistance of the companies, an industrial baseball league was formed early in the summer, and from the beginning to the end of the season the interest in the games was very great. No community sports in this section of the state ever aroused as much enthusiasm as did these ball games, which were played in the evening, from 6 to 8 o'clock. Everybody from the

general manager to floor sweepers were present to "root" for their favorite team. Valuable prizes were offered and the **Rome Wire Company** team won the pennant. The season closed with the teams standing as follows: **Rome Wire Company**, first; **Rome Manufacturing Company**, second; **Rome-Turney Company**, third; **Rome Metallic Bedstead Company**, fourth, and **Rome Brass & Copper Company** fifth.

Lack of cars has hampered to some extent shipments from the local plants of this city, but that and inability to get certain materials are practically the only difficulties encountered by Rome manufacturers this summer, as the labor supply has been ample. Wages have been high and working conditions good, and a general feeling of satisfaction and contentment has been manifested all along the line.

The annual convention of the Purchasing Agents' Association of Syracuse and Central New York, was held in this city. The delegates were taken to Riverdale and, after a tour of inspection of the **Metal Mill**, a branch of the **Rome Brass & Copper Company**, they had luncheon, and held a business session at the Riverdale Club. In the afternoon they were shown through the plants of the **Rome Wire Company, Rome Manufacturing Company, Rome Brass & Copper Company,** and **Rome Metallic Bedstead Company.** In the evening the visitors were dinner guests at the Teugega Country Club, and were addressed by **H. J. Rowland**, of the **Rome Brass & Copper Company.**

DETROIT, MICH.

NOVEMBER 1, 1920.

Business conditions in this section are showing the same tendency to slow up that is reported in other parts of the country. While there are a few pessimists who believe we are entering a period of depression, there are others, principally the "big" men in affairs, who feel the present slowing down in activities is due to a large extent to the presidential campaign, and that when that function has passed there will be a most decided change for the better. This is the hope of every one, and is generally believed by the best informed to be the real situation as it is today.

The general public was considerably surprised a while ago when **Henry Ford** released the information from his Highland Park plant that beginning almost immediately the prices of Ford cars would return to the pre-war basis. It was one of Mr. Ford's ways of surprising the general public, and so, for the time being, it has been forgotten, but there is no telling when he will do something else. Anyway, it has caused a slight reduction in prices of other commodities here for which every one is thankful, but as a whole has not caused any great upheaval among the great manufacturing plants. It is very doubtful if many here will follow him.

Of course Mr. Ford's act means the sale of more Ford cars, and, incidentally, the sale of more auto equipment, which, of course, is made up largely of copper, brass, aluminum and gray iron. There is no getting around the fact that Mr. Ford intends to sell Ford cars whether we are in for a depression or a period of prosperity.

It is with considerable regret that we are forced to record the decided slump in lake ship building, and the yards in Detroit and this section are practically at a standstill. This information is of interest because these plants have been heavy consumers of brass, copper and aluminum. Practically all ocean-going ships that have gone out of these yards within the last two years have been equipped with quantities of this metal. It is a question with many whether or not lake ship building, especially in this section, will be resumed again to any great extent in a long time.

While the automobile plants are not operating quite as heavily as last year, it is very gratifying that none of them is closed or likely to close. It is also gratifying to know that there is not a great amount of idle labor drifting about the city. Almost everybody seems to have work of some kind or another. But the automobile plants of course are the mainstay of every kind of labor, no matter whether it be skilled or unskilled.

COLUMBUS, OHIO

NOVEMBER 1, 1920.

There is a slump in the metal market in Columbus and central Ohio territory. Buying during the past month has fallen off to a considerable extent and the policy of consumers is now to buy only for the immediate future. It is now strictly a hand to mouth proposition, with users loath to take a chance on the future by making larger purchases. This condition started about three weeks ago and has been coming on in full force.

Shipping conditions, as far as metals are concerned, have improved slightly, although there is still considerable delay in receiving consignments. Stocks in the hands of metal using concerns are fairly good under the present conditions, and consequently they are not in the market to any extent. The tone of the market, however, continues good and better things are expected when surplus stocks of metals are consumed.

The Woodhill Brass Company, of Cleveland, has been chartered, with a capital of $100,000, to operate a foundry and machine shop. The incorporators are: **J. P. Ferencik, Frank R. Noss, H. S. Mitchell, John J. Ferito,** and **Joseph Hrubecky.**

The Metals Syndicate of America Company, of Cincinnati, has been incorporated, with a capital of $10,000, by **A. W. Murphy, F. S. McGowan, A. R. Manning, C. R. Megrith** and **J. P. Lamb.** The company will manufacture and sell all metals and products thereof.

The Delaware Brass Company, of Delaware, Ohio, has been chartered, with a capital of $125,000, to operate a foundry and deal in metals. The incorporators are: **G. W. Fisher, S. F. Fisher, R. E. Fisher, J. H. Fisher,** and **S. L. Fisher.**

A new factory building is being erected by the **East Side Copper Kettle Works Company**, of Bucyrus, Ohio. The cost of the new plant is approximately $75,000.

The Light Alloys Company, of Painesville, Ohio, has awarded a contract for the erection of a one-story factory, 75 by 140 feet, reinforced concrete construction. The cost will be in the neighborhood of $65,000.

CLEVELAND, OHIO

NOVEMBER 1, 1920.

Marked reaction in the automobile trade here, which has been followed by contraction in all lines in the metal industry related to it, has been the outstanding development of the month here. While some of the higher grade car makers here have not reduced prices, most of the ten leading manufacturers have done so. The effect has been to curtail rather than stimulate the demand. The claim by manufacturers is that dealers are unable to finance their next spring's needs in cars as yet, and manufacturers seek to co-operate with them by not overloading the distributor.

In any event production has been reduced, in some instances to the negligible quantity. It is therefore conservative to state that production is not better than 50 per cent. of normal, and this means there is a corresponding depreciation in demand for accessories, parts and equipment, of which the metal industry here contribute a large portion.

Most plants throughout the trade are following the lead of the automobile manufacturers by curtailing their labor requirements. It is safe to state that only about half of the labor employed three or four months ago is working.

Only one of the three outstanding factors that are assisting in reducing business in many other lines is having effect here, however. The unseasonably warm weather through October and the reduced buying power of the community do not affect the metal industry. The election, with its uncertainty, has had its usual retarding influence, however, and with this question settled it is believed by leading interests here that a restoration of confidence will follow, with increasing business with the turn of the year.

Meanwhile financial difficulties appear on the horizon. Foremost in this trade may be considered the problems of the **Standard Parts Company.** The company will be refinanced; stockholders will be asked to raise $11,500,000, banks will lend $4,000,000 and a syndicate will invest $3,000,000. The work is under direction of a reorganization committee, of which **C. S. Eaton**, of **Otis & Company,** is chairman. The Standard Parts Company is one of the largest automobile parts and accessories producers in the country. New stock will be issued to which shareholders will be asked to subscribe. Upon what the stockholders do will depend the

action of the banks in offering a loan. Committees representing the creditors and stockholders have approved the reorganization program. The entire plan, according to Mr. Eaton, is necessary in order to prevent liquidation of the company. It is believed by all concerned that the preservation of the company will do much to stabilize industrial conditions in the Cleveland district.

Receivers have been appointed by the common pleas court for the **Jones Gear Company.** They are Attorneys Wilfred Saeger and John A. Cline. The action follows the application of the **General Bronze Foundry Company,** which alleges the **Jones Gear Company** owes it $800. The petition stated that assets are sufficient but that the company has neither cash nor credit. **The Jones Gear Company,** a $2,000,000 corporation, is one of Cleveland's newest industries, being organized in 1918, and starting operations soon thereafter. Under the reorganization program by the court it is admitted by creditors and stockholders that neither will be at a disadvantage.

Suits for $300,000 damages have been filed by the **Aluminum Castings Company** against the **Lamson Company,** a New Jersey corporation, for alleged defective conveying equipment installed in the **Liberty Foundry** here and a plant of the **Aluminum Castings Company** at Detroit. The charge is denied.

More cheerful note to general conditions is seen in the plans for enlargement and extension of business by several companies here. **The Guide Motor Lamp Company** has taken possession of its new plant on the West Side, the first unit on a 12-acre tract having been completed. The company makes 53 different kinds of lamps for motor vehicles. It will install $100,000 labor saving machinery. Part of the original Guide plant has been taken by the **K-D Carburetor Company** and the **Eagle Carburetor Company,** two concerns under one roof. Three firms take over the carburetor company's plant on the East Side. They are the **Hastream Heater Company,** the **Pierce Plating Corporation** and the **General Bronze Foundry Company.** All gain larger quarters by these changes.

To care for increasing business, the **Bissinger Company,** magneto manufacturers, has taken a two-story factory building on East 21st street, which will enable it to increase its output.

Meanwhile the entire metal industry is confronted with the most serious labor problem that has yet developed out of war times. Pattern makers who have been on strike more than two months, announce they propose to organize a cooperative company and establish their own pattern shop. They are said to be selling stock at $50 a share to union members, not more than five shares to a member. The plan is to open a shop employing about 100 members, to make wood and metal patterns. This will be twice as large as the largest pattern shop in the Cleveland district, F. B. Reid, business agent for the pattern makers' union, claims. It is claimed by union officials that similar shops are working in Philadelphia, Boston and Chicago. About 500 patternmakers went out on strike.

In keeping with the trend among all manufacturers toward the open shop, and which is receiving attention of the Labor Relations Committee of the Cleveland Chamber of Commerce, the pattern manufacturers have come out flatly in strong publicity for the open shop. Twenty-seven manufacturers are in favor of the move. It is pointed out by these firms that pattern makers have had wage increases to 155 per cent above 1914 wages. They were receiving $1.25 an hour for a 44-hour week and double time for overtime and holidays. They were offered $1.37½ an hour, and $1.50 six months later, but refused and demanded $1.75 an hour. Pattern manufacturers say other high skilled shop workers receive not more than $1, this to tool makers, while molders get 90 cents an hour. The contention of manufacturers is that pattern makers should hardly expect to receive twice as much as other skilled workers.

The Thomart Truck Company, Akron, is planning to enlarge its Kent plant to make a production of 25 to 30 chassis a day. These are for a new speed truck the company is designing. **W. G. Thompson,** president and **James L. Stewart,** secretary and general manager, are in charge actively. **W. A. Parrish** is chief engineer.

The Globe Motors Company, a new concern, has purchased a tract of land east of Cleveland and plans the immediate construction of a 40,000 square feet plant, the first unit in a factory to have 180,000 square feet. The company will make a small car, demonstrations of which are expected before the end of this year. **Charles H. Davies,** president of the new **Globe Company,** is the founder of the **Supreme Motors Corporation,** Warren, Ohio. The Supreme motor will be used in the Globe car. Other officers are: **W. E. Telling,** vice-president; **F. W. Staffeld,** secretary; **L. E. Holmden,** treasurer.

The Templar Motors Corporation is rebuilding its plant in Lakewood, west of Cleveland, following the fire which did $3,000 damage.

The Berger Brass Manufacturing Company has leased a factory building at Woodland avenue and East 92nd street, where it will manufacture a general line of brass goods.

The National Lamp Works of the **General Electric Company** has purchased six acres in the southeast section of the city, where a large plant for the manufacture of lamp parts will be erected.

LOUISVILLE, KY.

NOVEMBER 1, 1920.

Business with the Louisville coppersmiths and casting shops continues excellent as a whole, everyone apparently having plenty of work in hand and good prospects ahead of them. Louisville, unlike many other cities, hasn't felt the slump in industrial activity to any great extent, this being due largely to diversified industries. There are so many different kinds of local industries that a general slump in all commodities would be necessary to affect things here very much, while in cities which depend on automobiles, tire or specialty production, a big break in demand in one line spells general dullness.

Louisville metal working shops during the past year or two have taken on a considerable amount of automobile work, making special castings, sheet parts, etc., and the slump in the automobile trade has been felt a little by some of these concerns, but other work has been coming in nicely, and the shops are not suffering for business.

The Standard Milk Machinery Company reports that the slump in other lines is not affecting it, and that there is more business in sight than it can take care of, as a result of rapid improvement in dairy operations.

Hines & Ritchey report a very good volume of work for regular customers, there being a good deal of kettle work floating around just now. This company quit casting three or four years ago, and is doing sheet and tube work only.

Some good business is in sight locally when the **National Candy Company, F. A. Menne** division, starts work on a million-dollar plant, which will be erected sometime in 1921. A considerable amount of copper kettle work will be needed in equipping the new plant.

Prices of metals are weaker all along the line. Local houses report that ingot is worth 18 to 18½c.; sheet copper, base, 25½; tubes, 30½; heavy scrap copper, 15; light, 12; heavy scrap brass, 10½; light, 8c.; lead, 7½c. to 8c.

The Standard Sanitary Manufacturing Company, having completed a large addition to its brass shops, has started work on another $25,000 addition to its power plant, part of the new building to be used in connection with finishing baked enamel wash tubs. The company has spent more than a hundred thousand dollars on the A. & O. plant additions this year.

The **Belknap Hardware & Manufacturing Company** announced a few days ago that it had plans drawn for a seven-story warehouse, and also for a 12-story warehouse and office building, but that it would not start work on them until building costs lowered considerably.

Plans for additions to the **Kentucky Wagon Manufacturing Company,** costing a considerable sum of money, are being held up until some time next year, pending lowering prices on material and labor.

The **Independent Brass Works** reports a very active volume of business, having a good deal of out-of-town work, and a considerable volume for the **Cheatham Switch & Signal Company,** of Louisville. **J. W. Rademaker** also reports a considerable volume of special ship work that is going to the Hog Island yards.

Prices on coal and coke are lower and supplies are now coming through much better than they were. Fuel oil, used in some of the larger metal working plants for fuel, is steadily advancing. In fact, the best grades of Kentucky crude are now bringing around $4.50 a barrel at the wells.

PROVIDENCE, R. I.

OCTOBER 18, 1920.

Announcements of curtailment in production and reductions in wages throughout the textile industry of Rhode Island during the past month have been reflected in the generally unsettled industrial conditions of the State, which have affected every line of business. The various branches of the metal trades have been caught in this chaotic situation and have suffered depressions, more or less severe.

While a majority of the metal working plants are operating on full time schedules, few, if any, are being rushed to the extent that has characterized them for many months previously. Among the structural metal workers there is an apparent improvement in activity as compared with a few months ago, while sheet metal workers are especially busy.

Among the small tool machinists there is a noticeable falling off in the volume of business and the prospects are not considered over and above favorable for any immediate revival. Early in the month the big concern of Brown & Sharpe Manufacturing Company made a reduction of between 400 and 500 in its working force and further curtailment is not unexpected.

Orders continue to be received by the manufacturing jewelers, although not in such numbers, or as large as is usual at this season of the year, for the holiday trade. All the factories are running, however, about as they have been for some time, but the manufacturers are very optimistic concerning the chances for continued good business during the coming months. One of the special features of this season's business is the mesh bag which retains as great a popularity as ever.

One of the busiest plants to be found in the Blackstone Valley at the present time is that of the R. Plews Manufacturing Company, at Central Falls, engaged in the manufacture of tin cylinders and general sheet metal work.

The Universal Chain Company, Inc., of Providence, capitalized at $25,000 with 250 shares of common stock without par value, has been granted a charter under the laws of Rhode Island by Secretary of State J. Fred Parker. The incorporators were **Philip C. Joslin, Ira Marcus** and **Archie O. Joslin,** all attorneys of Providence. The concern will manufacture jewelry and jewelers' findings, according to the provisions of its charter. The president is **Wilhelm Forstner,** of this city, who has another and larger chain business at Irvington, N. J., under the name of the **Forstner Chain Company;** the secretary and treasurer is **Otto Winkler.** Besides these, the board of directors consists of **Hermann Weinacker** and **Frederick A. Dieterich.** The corporation has taken over the plant and business that has been conducted for a number of months by **Weinacker & Dieterich,** at 128 North Main street.

At meetings of the **Gorham Manufacturing Company,** the **Gorham Company** and **The Silversmiths Company,** held at the executive offices of these corporations in Elmwood, this city, on October 27, it was decided to add another vice-president to the list of officials, and **Franklin A. Taylor,** of Philadelphia, president of **Keystone Watch Case Company,** of that city, was elected and will assume his new duties on November 15, at the same time becoming general manager of the three corporations. While a considerable routine business was transacted, no other changes were made in the personnel of the officers.

An addition which will cost upwards of $30,000 is to be made to the manufacturing jewelry factory of **Whiting & Davis,** at Plainville. The new building will allow the firm to consolidate several of its departments and to afford opportunity for the installation of electric generators where the firm may develop its own electricity.

The Auto Metal Company, of Providence, which will manufacture radiators and other parts of automobiles and accessories, has been granted a charter under the laws of Rhode Island by Secretary of State Parker. The amount of the capital stock is $50,000 and the incorporators are **Louis Balotow, Charles Balotow** and **Abraham Gershkoff,** all of Providence.

The M-B Tool Company, of Providence, has increased its capital stock from $30,000 to $50,000, according to the statement of an amendment to its charter that has been filed at the office of the Secretary of State.

The new building of the **Standard Nut and Bolt Company,** at Valley Falls, is practically complete, and will be the means of relieving the congestion which has been in evidence at the plant for some time. Business at the works is said to be very good, and a full-time schedule is being maintained.

The partnership heretofore existing between **Edwin Smith** and **John Rhind,** under the firm name of the **Standard Burnishing Company,** at North Attleboro, has been dissolved. The business will be continued by the former in the **T. I. Smith Company's** building under the old name.

Herbert J. Astle, of the firm of **H. J. Astle & Company,** manufacturers of tin and sheet metal ware, has purchased the four-story brick building at the corner of Orange and Friendship streets that has been occupied by the concern for more than forty years. The lot contains about 2,165 square feet.

BIRMINGHAM, ENGLAND

OCTOBER 18, 1920.

Whilst business generally has fallen off, the non-ferrous trades continue well occupied. The brassfounders, in particular, are busy. Progress in house building, which so far has been lamentably slow, is now being speeded up. The result is an increased home demand for all kinds of house fittings. Makers of water fittings also have in hand substantial export orders, particularly from Australia. The tubes and sheet mills still have plenty of work. The electrical trades are fairly well employed. In the automobile trade there has been a great falling off of home buying. The increased cost of petrol and the imposition of higher license charges and insurance rates have accentuated the slump, which, however, is due in the main to other causes. High wages and low output, together with the cost of material, have led to a continuous increase in prices, with the result that many orders have been cancelled. American competition is very keenly felt and some of the big motor car firms here are contemplating a cut in prices. All trades which depend to any extent upon the foundries are hampered by a lack of castings. The effects of last year's strike in the foundry trade are still felt, not only in arrears of work, but also in the lessening of the number of skilled men, many having gone into other trades.

For some weeks the electrical trades were involved in a dispute which threatened to affect not only the workers engaged in the manufacture of electrical apparatus and accessories, but to a large extent also the general engineering and several other trades. It arose out of the case of one man, a foreman, in the employ of the electrical department of **Cammell, Laird & Company,** at their **Penistone Works,** near Sheffield. The foreman having, on his appointment, resigned from the **Electrical Trades Union,** the Union demanded his dismissal, and, on this being refused, prepared for a general strike. **The National Employers' Federation,** to which employers in the electrical trades are affiliated, retaliated with notices of a general lock-out of members of the **Electrical Trades Union.** Whilst employers do not insist that foremen should not be trade unionists—in fact they are precluded by arrangement with the trade unions from asking a man whether he belongs to a union or not—they claim that perfect liberty in regard to such appointments is essential to efficient management. The Labor Minister set up a Court of Equity to deal with the dispute and the men agreed to suspend their strike notices and submit their case. The employers, however, declined to withdraw the lock-out notices, and for some time a disastrous deadlock was feared. Sympathetic strike action was expected from all classes of the electrical workers, including those at many public and private power stations. The tramway and other services of London and several other towns were threatened with paralysis and many factories dependent upon electric power would have been stopped, with consequent unemployment in other trades. But, at the last moment, friendly intervention brought about a settlement in which the men conceded the principle for which the employers contended.

MONTREAL, CANADA

NOVEMBER 1, 1920.

The Canadian Car and Foundry Company were running to full capacity on foreign and domestic orders which promised to keep them busy all winter.

Negotiations are pending for the closing of a lease to extend for a period of years, between the **E. J. Woodison Company,** manufacturers and dealers of foundry equipment and supplies, and **Canadian Pacific Railroad,** for a piece of land and buildings located on St. Patrick street, in the west end manufacturing district, where they will carry a full line of Woodison's entirely Canadian made foundry supplies and polishing equipment.

The Gurney Foundry Company, Ltd., Toronto, has purchased the plant, equipment and patterns, of the **Canada Stove Company,** located at St. Laurent. This is one of the largest stove foundries located in the eastern part of Canada, and they operate a large polishing and plating plant. The head office of the Gurney Company will remain in Toronto. Additional equipment will be installed.

The Berliner Gramophone Company are building new additions to their factory, costing $100,000, to take care of their increasing business in the manufacture of gramophones and Victor records.

The feeling during October in the manufacturing trade is that the summit of high prices has been reached, and the markets for brass goods are depressed. This exercises a restraining influence on buying, and purchasers are not placing orders unless at a reduction in price. On the other hand, sellers are not inclined to cut prices where it can be avoided, and the result is that little new business has been booked this month.

Business in scrap metals is dull and the outlook is not very encouraging. The tendency on all lines is downward in sympathy with raw materials, which have dropped considerably this past two months. The sudden let-up in business is allowing the manufacturers to catch up on their orders. The factories are running their normal forces with the prospects of a reduction of men or hours of employment.

GOVERNMENT PUBLICATIONS

Summarized Reports of Principal Investigations Being Conducted at the Mining Experiment Station of the Bureau of Mines. Compiled by J. D. Secrest; issued by the Bureau of Mines, Washington, D. C.

Enamels for Sheet Iron and Steel. Technological Paper No. 165, Bureau of Standards, by John B. Shaw.

Mineral Products of the United States in 1917. Introduction by H. D. McClaskey and summary by Martha B. Clark; issued by the U. S. Geological Survey, Washington, D. C.

Gold and Silver in 1918. General Report by J. P. Dunlop, issued by the U. S. Geological Survey, Washington, D. C.

B. F. Cobalt, Molybdenum, Tantalum, Titanium, Radium, Uranium and Vanadium in 1918. By Frank L. Hess. Published by the U. S. Geological Survey, Washington, D. C.

Nickel in 1918. By Frank L. Hess. Issued by the U. S. Geological Survey, Washington, D. C.

Lime in 1918. By G. F. Loughlin and Herbert Insley; issued by the U. S. Geological Survey, Washington, D. C.

Report of the War Trade Board. The report which describes the administration and effect of the war trade control from June 15, 1917, to June 30, 1919. Copies of this report can be obtained from the Government Printing Office, Washington, D. C.

TRADE PUBLICATIONS

Hytempite.—A set of full-page reprints from various trade journals of advertisements by the Quigley Furnace Specialties Company, New York.

Strength in Union.—A pamphlet dealing particularly with the valuation and report department of Ford, Bacon and Davis, Engineers, 115 Broadway, New York City.

Rego Welding and Cutting Equipment.—Catalogue No. 20, describing the apparatus for welding and cutting, which is manufactured by the Bastian-Blessing Company, Chicago, Ill.

Light, Heat, Power.—A folder which names and illustrates some of the power plants built by Dwight P. Robinson & Company, Inc., 125 E. 46th street, New York City.

Power Transmission Machinery.—A catalogue issued by A. & F. Brown and Company, Elizabethport, N. J., covering and illustrating their power transmission specialties.

Report of the Steel Strike.—A copy of a discussion by Charles Piez, president of the Link-Belt Company, Chicago, written at the request of the Independent, New York City.

The Evolution of a Commercial Force.—A reprint of an article from the Brass World and Platers' Guide, August, 1914, published by the Hanson and Van Winkle Company, Newark, N. J.

Eclipse Air Brush.—Booklet H, issued by the Eclipse Air Brush Company, 79 Orange street, Newark, N. J., which describes their model F and model G Air Brushes and accessory equipment.

Electric Furnaces.—A pamphlet showing the various kinds of electric furnaces made for different uses in the United States and Europe issued by the Acheson Graphite Company, Niagara Falls, N. Y.

The User's Experiences Told by Himself.—A booklet of letters of commendation from users of machinery made by the American Foundry Equipment Company, 366 Madison avenue, New York City.

Foundry Costs.—A pamphlet enclosing a reprint of an article by John P. Jordan, vice-president and director of C. E. Knoeppel & Company, published by the National Association of Cost Accountants.

Acheson Electrodes in Use.—A bulletin issued by the Acheson Graphite Company, Niagara Falls, N. Y., naming and illustrating some of the various types of electric furnaces in which Acheson electrodes are used.

American Foundry Flasks.—A catalogue describing and illustrating various flasks of the universal round and square pin system, made by the American Foundry Equipment Company, 366 Madison avenue, New York City.

How to Keep the Guess Work Out of Welding.—A booklet issued by the Chicago section of the American Welding Society, which can be obtained by writing to the American Welding Society, 608 So. Dearborn street, Chicago, Ill.

Booth Rotating Electric Furnace.—Bulletin issued by the Booth Electric Furnaces Company which contains pictures of their furnace in actual operation, copies of letters of commendation from users, a partial list of customers and a very well illustrated description of the furnace itself.

Stefco Structural Steel Buildings.—A folder illustrating the sectional steel one-story mill shape buildings in widths up .o 60 feet, heights up to 16 feet, and lengths to any distance. The advantage of this kind of building is the ease and speed with which it can be set up or knocked down and moved.

Ajax Metal Products.—The export catalogue of the Ajax Metal Company, Philadelphia, Pa. This catalogue has been issued in two editions, English and Spanish. It is perhaps one of the most comprehensive books of its kind in the metal field for export use, and should be of considerable assistance to export houses.

Molding Machine No. 61.—A booklet describing this molding machine, issued by the Whiting Corporation, successors to the American Foundry Equipment Corporation, New York City. This booklet is freely illustrated and describes in detail the operation and parts of the machine which makes the complete mold.

Wayne Liquid Storage System.—One of the most complete loose-leaf catalogues we have ever seen on oil burning systems and equipment, also filtration equipment. It covers oil in every possible field, and includes those of special interest to the metal trades, such as brass furnaces of all kinds, ladle heaters and complete equipment for the oil burning layouts.

Profiting from Light Surfaces.—A folder issued by the Hilo Varnish Corporation, Brooklyn, N. Y., explaining and illustrating the advantages of their new machinery enamel, Lite-Gray. It is supplemental to their educational campaign featuring this product which the Hilo Corporation is carrying on in the advertising pages of the technical press.

General Fire Prevention.—The August number of this publication put out by the General Fire Prevention Company, Youngstown, Ohio, which includes among other things a review of the Metal Lathe Association, by W. B. Turner, president. The whole issue is devoted exclusively to the activities of the Associated Metal Lathe Manufacturers, Inc., Chicago, Ill.

The Cause of Skin Sores and Boils Among Metal Workers.—Results of an investigation by the research staff of E. G. Houghton & Company, Philadelphia, Pa., manufacturer of oils and leathers. This booklet should be in every metal working and plating shop. It is written in a non-technical fashion, easily understood, and although essentially practical, scientifically accurate.

The 1920 Yearbook of the Merchants' Association of New York.—The yearly publication which contains a summary of the activities of the association for the year ending May 1, 1920. It also contains reports of the President Mr. William Fellowes Morgan, the Secretary Mr. S. C. Mead, and of the following service bureaus: Membership Bureau, Publicity Bureau, Bureau of Research, Anti-litter Bureau, Convention Bureau, Legislative Service Bureau, Industrial Bureau, Foreign Trade Bureau, and Traffic Bureau.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$600	$650
American Brass	100	185	190
American Hardware Corp	100	135	139
Bristol Brass	25	23	25
International Silver, com	100	30	..
International Silver, pfd	100	88	92
New Jersey Zinc	100	160	165
Rome Brass & Copper	100	140	150
Scovil Mfg. Co	100	340	380
Yale & Towne Mfg. Co	..	275	285

Corrected by J. K. Rice, Jr., & Co., 36 Wall Street, New York.

METAL MARKET REVIEW

Written for The Metal Industry by W. T. Partridge.

COPPER

The result of the pressure to sell by producers and the holding off of consumers was a drop of 3 to 3½c. per pound in the price of electrolytic copper in October. In the outside market also prices receded from 3 to 3½c. per pound on the various positions. At the close of the month, however, there was increased interest shown by both foreign and domestic consumers and although there was a conservative feeling throughout the trade, an increased volume of business was transacted at 15c. delivered for November and December shipment and at 15¼c. delivered for shipment over the first quarter of next year. In the outside market business was done as high as 15½c. delivered for shipment over the first quarter of 1921, and there was less and less metal available even for this year's shipment as the month waned. One feature of interest during the last half of the month was the increasing frequency of auction sales on the Metal Exchange as a result of liquidation of delinquent contracts.

On October 1 a stronger feeling was made evident through the sale of 400 tons in lots of 100 tons each on the Metal Exchange on account of whom it may concern. These transactions were made at 14¾c. to 14.82½c. f. o. b. refinery for prompt shipment, subject to buyers' specifications. These prices are equivalent to 15 to 15⅛c. delivered. Some of this metal was bought for export.

Usually at this time of the year the power plants in the west and other large consumers of highly manufactured products do not place important contracts and this year the tendency to remain out of the market was intensified by the downward tendency in the prices of copper. Wire drawers and electrical equipment manufacturers, as well as brass founders, however, are now showing more disposition to place contracts, as there is a feeling that the price of unwrought copper has touched bottom. The same is true of manufactured products of copper and brass, prices for which have declined several cents per pound in the last three weeks. Although consumers are not buying freely, the interest throughout the trade is widespread and the market is broadning from day to day. Lake copper, which early in the month sold as high as 18½ delivered, today is offered at 15½ delivered, and casting copper, which was held at 17½c. at the beginning of October is today offered at 14½c., f. o. b. producers' works.

Statistically, the market has not encouraged purchases. Consumption throughout October is, both on domestic and foreign account, under rather than over current output. In fact, there was probably an increase in surplus stocks, which today are estimated at close to 600,000,000 tons. Exports in October, however, were probably ⅓ larger than they were in September. The October outgo is estimated at approximately 30,000,000 pounds, whereas recent returns indicate that the September foreign shipments were scarcely more than 22,000,000 pounds.

Domestic consumption is estimated to have been under rather than over 80,000,000 pounds, so that with exports, deliveries into domestic and foreign consumption in October were only about 102,000,000 pounds. Imports are estimated at 30,000,000 pounds and domestic smelter output about 110,000,000 pounds. It is possible, however, that domestic production will be decreased sharply, as not a few of the small companies are losing money at current selling prices. Even some of the largest companies have only a narrow margin of profit.

TIN

The tendency of tin prices was downward in October, here and abroad and in all positions. The two factors of prime importance were the constant offerings of special lots of spot tin in liquidation of delinquent contracts and the relatively low rate prevailing for sterling exchange. The first caused depression in spot metal and the second was reflected in future positions. The highest prices were established on October 1, when Straits sold at 43.50c. for prompt and at 43.75c. for future shipment. Other kinds were fractionally lower. The lowest prices were reached October 18, when Straits sold at 37.75c. for spot and at 38.50c. for future deliveries. The drop in prices on the various varieties ranged from 5.00-5.75c. on prompt and 5.00-5.25c. on futures. There was a recovery during the last ten days of the month of 2.50-2.75c. on spot and 3.00-4.25c. on futures. The closing prices on October 29 were 40.87½c. for spot, and 42.75-43.00c. for future Straits. Banca sold at approximately the same prices; American pure brought 40c. for spot and 99% tin sold at 39.50c. for spot and 40.50c. for futures. The net decline for the month ranged from 2.25c. to 3.25c. per pound on prompt, and from 1.00c. to 2.00c. per pound on future shipments. Deliveries into domestic consumption in October amounted to 3,415 tons, against deliveries in September of 4,860 tons. Stocks on November 1 were, 3,191 tons, of which 2,041 tons were in store.

LEAD

The American Smelting & Refining Company reduced its basis ½c. per pound for prompt lead from 7.75c. to 7.25c. New York, and from 7.50c. to 7.00c. East St. Louis on October 15, thereby cutting under prevailing outside market figures ¼c. per pound. Outside market prices were immediately reduced, the decline carrying by the end of the month to 7.00c. New York, 6.60c. East St. Louis, while the leading interest made no further change. Thus, while the spread between the two markets at the beginning of the month was ⅛c. per pound, at the end of the month there was a difference of ¼c. in the New York quotations and of 60 points in East St. Louis figures. November shipments were held at 6.87½c. New York, 6.55c. East St. Louis. The market, at the close of October, was quiet and easy in tone, with large arrivals of foreign metal on hand, the tendency indicating that domestic output would soon outstrip shipments unless demand were increased.

ZINC

The zinc market in October suffered less than other metals, the decline in prices amounting to only 30 points on New York prompt, prime Western from 7.75c. October 1, to 7.45c. at the end of the month. East St. Louis quotations declined 70 points from 7.60c. October 1 to 6.90c. at the end of the month. Brass special during October declined 65 points, from 7.75c. to 7.10c. These prices include reshipment zinc, which was freely offered throughout the entire period. After a very quiet and unsettled condition the outlook brightened in the closing days, with apparently an awakening interest that gave promise of activity later in the year.

ALUMINUM

With large stocks of imported aluminum on hand and almost complete absence of demand, it was not surprising that outside market prices of aluminum in October declined 1.00c. per pound on virgin 98-99% from 29-30c. to 28.29c. per pound; 2c. per pound on 98-99% remelted to 26-27c., and 3c. per pound on No. 12 alloy to 24-25c. Producers' prices, effective October 1, but not publicy announced until October 13, were cut 2c. per pound, the schedule as corrected being 33.10c. for 99% and purer, 32.90c. for 98-99% pure, and 32.10c. for No. 12 alloy; sheets No. 18 gauge, 47.20c. Stagnation in the automobile industry, with cancellation of contracts, is reflected in the decline of prices for aluminum. Importations of aluminum in August, according to reports that became available during October, were heavy, there being 1,432 tons received, as compared with 956 tons in July. Total importations during first eight months 1920 amounted to 13,279 tons. Exports in August were small, there being only 44 tons outgo, as compared with 200 tons in July. Total exports in the first eight months of the current year amounted to 3,661 tons.

ANTIMONY

The downward trend in prices of antimony continued in October, there being a total decline of ⅝c. per pound from 7.00c., f. o. b. New York, at the beginning of the month, to 6.37½c. on October 29, for spot and October carloads. Large supplies recovered from war material, in addition to surplus carried over and already contracted for when the war was ended, in combination with the rapidly falling off in demand, has resulted in a decline of 6½c. per pound from 12.50c., the highest level established for the current year and which was in force during January, 1920.

SILVER

Fluctuations in the price of bar silver of foreign origin in October covered a range of 15¼c. from 91½c., the highest price on October 1, to 76¼c., the lowest level, on October 19. The closing was made at 80½c., representing a net decline of 11c. from the opening. Silver of domestic origin was automatically pegged at 99½c. per ounce throughout the month. The Director of the Mint reports total purchases made under the Pittman Act, to October 28, inclusive, amounting to 19,952,507 ounces. Total exports of silver, from January 1 to October 10, inclusive, according to Washington report, amounted to $100,128,471. Total importations, January 1 to October 10, inclusive, amounted to $75,211,138.

QUICKSILVER

Like all other metals in October, quicksilver suffered a decline in price due to lack of demand, business generally having come to almost a standstill condition. From $75 per flask of 75 pounds, the price prevailing throughout September and until October 5, when the decline began, there was a gradual recession to $70 by October 14. No further change occurred until the break in London on October 20, when another sharp decline was made of $10 per flask, which carried to $60 per flask. This figure remained unchanged at the end of the month.

PLATINUM

The September price of platinum—$105 to $115 per ounce—prevailed during the past month until October 29, when there was a decline to $95 to $105 per ounce. U. S. Department of Commerce Statistics for 1919, which became available during the month, show an increase of 177 ounces in domestic output of crude platinum, to 824 ounces. The total production of refined platinum, however, showed a decrease, there being only 11,759 ounces in 1919. The estimated world production in 1919 was 67,180 ounces, indicating an increase of 4,897 ounces over the preceding year, but the total is still far below the normal pre-war production.

OLD METALS

Paralysis in trade generally, during October, resulted in heavy declines along the entire list of items in old metals. Copper scraps, which were in the lead as sellers early in the month, declined 3c. each to 10c. for light copper, and to 11c. for uncrucibled copper; 3½c. to 12c. for strictly crucibled metal by the end of the month. Composition scrap and composition turnings were each off 3c. to 11c. for the former and to 9c. for the latter. Pure tinfoil, old sheet aluminum and No. 1 pewter declined 6c. each to 26c. for tinfoil, to 24c. for aluminum and to 22c. for pewter. Clean aluminum turnings and borings were down 3c. to 8.50c., and block tin pipe declined an equal amount, to 32c. per pound. Old cast aluminum was off 5c. to 14c., and aluminum clippings were down 4c. to 20c. Clean red car boxes declined 2½c. to 9.50c., and heavy brass 2c. to 6.50c.. New zinc scrap and hand-picked type shell cuttings each were off 1c. to 5c. Heavy lead, also, was down 1c. to 5.25c. per pound. Brasses were heavy, and each declined 1½c. to 6.50c. for No. 1 turnings, to 8c. for new clippings, and to 8.50c. for special heavy. Dross suffered less, each only ½c. cut to 3c. for stereotype, and to 2.50c. for electrotype. Battery lead was down ¼c. to 2.75c. At the end of the month, there was an expectant attitude in the hope for better conditions after the national election. One unusual feature in the latter part of the month was the arrival of scrap from Europe, with rumors of larger tonnages on the way.

WATERBURY AVERAGE

Lake Copper. Average for 1919, 19.55. 1920—January, 19.25 February, 19.125.—March, 18.875.—April, 19.125.—May, 19.00.—June, 18.50—July, 19.00—August, 18.75—September, 18.75—October, 16.875.

Brass Mill Zinc. Average for 1919, 8. 1920—January, 9.75 February, 9.40.—March, 9:15.—April, 8.85.—May, 8.30.—June, 8.15—July, 8.45—August, 8.55—September, 8.45—October, 7.50.

OCTOBER MOVEMENT IN METALS

	Highest	Lowest	Average.
Copper:			
Lake	18.50	15.50	16.869
Electrolytic	18.00	14.75	16.30
Casting	17.50	14.62½	16.012
Tin	41.75	36.75	40.525
Lead	7.75	7.00	7.40
Zinc (brass special)	7.80	7.38	7.54
Antimony	7.00	6.37½	6.625
Aluminum	30.00	28.00	29.125
Quicksilver (per flask)	$75.00	$60.00	$67.10
Silver (cts. per oz.) Foreign	91½	76¼	83.48

Metal Prices, November 1, 1920

NEW METALS

Open Market

	Cents
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER.	
Manufactured 5 per centum.	
Electrolytic, carload lots, delivered	15¼
Lake, carload lots, delivered	15½
Casting, carload lots, delivered	14½
TIN—Duty free.	
Straits of Australian, carload lots	40
LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	6⅞-7¼
ZINC—Duty 15%.	
Brass Special	7.40
Prime Western, carload lots	7.50
ALUMINUM—Duty, Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	....
100-lb., f. o. b. factory	....
Ton lots, f. o. b. factory	28-33.10
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	6.37½
NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, strip and wire, 20%.	
Ingot	43.00
Shot	43.00
Electrolytic	45.00
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.60-$1.75
BISMUTH—Duty free	2.55- 2.57
CADMIUM—Duty free	1.40- 1.50
CHROMIUM METAL—Duty free	Nominal
COBALT—97% pure	Nominal $6.00
QUICKSILVER—Duty 10% per flask of 75 pounds	$60.00
PLATINUM—Duty free, per ounce	$95-$105
SILVER—Government assay—Duty free, per ounce	.99½
GOLD—Duty free, per ounce	$20.67

Metal Prices, November 1, 1920

INGOT METALS

Silicon Copper, 10%	according to quantity	49	to55
Silicon Copper, 20%	" " "	36	to40
Phosphor Copper, guaranteed 15%	" " "	25	to38
Phosphor Copper, guaranteed 10%	" " "	24	to37
Manganese Copper, 30%	" " "	50	to56
Phosphor Tin, guarantee 5%	" " "	50	to60
Phosphor Tin, no guarantee	" " "	45	to55
Brass Ingot, Yellow	" " "	11½	to13
Brass Ingot, Red	" " "	15½	to17½
Brass Ingot	" " "	16½	to19
Parsons, Manganese Bronze Ingots	" " "	20½	to22
Manganese Bronze Castings	" " "	32	to42
Manganese Bronze Ingots	" " "	17	to21
Manganese Bronze Forgings	" " "	30	to40
Phosphor Bronze	" " "	24	to30
Casting Aluminum Alloys	" " "	30	to32
Monel Metal	" " "	38	to..

OLD METALS

Buying Prices		Selling Prices
11½to12	Heavy Cut Copper	13¼to13¾
11¼to11¾	Copper Wire	13 to13½
9½to10	Light Copper	12 to12½
11½to12	Heavy Machine Comp.	13½to14
7½to 8	Heavy Brass	9½to10
5½to 6	Light Brass	7½to 8
6½to 7	No. 1 Yellow Brass Turnings	8 to 8½
11 to11½	No. 1 Comp. Turnings	13 to13½
4.25	Heavy Lead	4.90
4.25	Zinc Scrap	5.00
7 to10	Scrap Aluminum Turnings	8 to11
16 to18	Scrap Aluminum, cast alloyed	18.50to20.00
19.00	Scrap Aluminum, sheet (new)	21½
26.00	No. 1 Pewter	30.00
15.00	Old Nickel anodes	17.00
23 to25	Old Nickel	27 to29

BRASS MATERIAL—MILL SHIPMENTS

In effect August 23, 1920.

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass	Bronze.
Sheet	$0.22¼	$0.24	$0.25½
Wire	.23¼	.25	.26½
Rod	.20¼	.25	.26½
Brazed tubing	.36	..	.40¾
Open seam tubing	.36	..	.40¾
Angles and channels	.41	..	.45¾

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.23½	$0.25¼	$0.26¾
Wire	.24½	.26¼	.27¾
Rod	.21½	.26¼	.27¾
Brazed tubing	.37¼	..	.42
Open seam tubing	.37¼	..	.42
Angles and channels	.42¼	..	.47

SEAMLESS TUBING

Brass, 27c. to 29c. per lb. base.
Copper, 28c. to 30c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	24½c. net base
Muntz or Yellow Metal Sheathing (14"x48")	22¼c. " "
Muntz or Yellow Rectangular Sheets other than Sheathing	23¼c. " "
Muntz or Yellow Metal Rod	20¼c. " "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	24½c.-25½c. net base
From stock	26½c.-30½c. net base

BARE COPPER WIRE—CARLOAD LOTS

18¾c. to 20c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	27½c. per lb. base
100 lbs. to 300 lbs. in one order	28½c. " " "

ZINC SHEET

Duty, sheet, 15%. Cents per lb

Carload lots, standard sizes and gauges, at mill, 12½c. basis less 8 per cent. discount.

Casks, jobbers' prices	14c.
Open casks, jobbers' prices	14½c

ALUMINUM SHEET AND COIL

Aluminum sheet and coil, base price....49.10c per lb. contract price
Aluminum sheet and coil.....65-70c per lb. open market price

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c., over 25 to 50 lbs., 17c. over, less than 25 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

MONEL METAL

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	42
Cold Drawn Rods (base)	56
Hot Rolled Sheets (base)	55

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 84c. to 86c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 80c. to 83c.

NICKEL ANODES

85 to 87% purity	.55c. per lb.
90 to 92% "	.57½c. per lb.
95 to 97% "	.60c. per lb.

Supply Prices, November 1, 1920

CHEMICALS

Acid--		
Boric (Boracic) Crystals	lb.	.30
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.08
Hydrochloric, C. P., 20 deg., Carboys	lb.	.10
Hydrofluoric, 30%	lb.	.50
Nitric, 36 deg. Carboys	100 lb.	8.28
Nitric, 42 deg. Carboys	100 lb.	8.90
Sulphuric, 66 deg., Carboys	lb.	.04½
Alcohol—		
Denatured	gal.	1.50
Alum—		
Lump, Barrels	lb.	.06½
Powdered, Barrels	lb.	.07½
Aluminum sulphate, commercial tech	lb.	.06
Aluminum chloride solution	lb.	.30
Ammonium—		
Sulphate, tech., Barrels	lb.	.08½
Sulphocyanide	lb.	1.50
Argols, white, see Cream of Tartar	lb.	.80
Arsenic, white, Kegs	lb.	.18
Asphaltum	lb.	.35
Benzol, pure	gal.	.75
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.10½
Calcium Carbonate (Precipitated Chalk)	lb.	.20
Carbon Bisulphide, Drums	lb.	.12
Chrome Green	lb.	—
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.60
Carbonate, Barrels	lb.	.29
Cyanide	lb.	.68
Sulphate, Barrels	lb.	.09
Copperas (Iron Sulphate, bbl.)	lb.	.04
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.80
Crocus	lb.	.15
Dextrin	lb.	.25
Emery Flour	lb.	.10
Flint, powdered	ton	—
Fluor-spar (Calcic fluoride)	ton	—
Fusel Oil	gal.	6.50
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	—
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.04
Lead Acetate (Sugar of Lead)	lb.	.35
Yellow Oxide (Litharge)	lb.	.25
Mercury Bichloride (Corrosive Sublimate)	lb.	1.95
Nickel—		
Carbonate Dry	lb.	.80
Chloride, 100 lb. lots	lb.	.55
Salts, single, bbls	lb.	.16
Salts, double, bbl	lb.	.15
Paraffin	lb.	.30
Phosphorus—Duty free, according to quantity		.36-.42
Potash, Caustic, Electrolytic 88-92% fused	lb.	.30
Electrolytic 70-75%, fused	lb.	.24
Potassium Bichromate, Casks	lb.	.28
Carbonate, 80-85%	lb.	.23
Cyanide, 98-99½%, 100 lb. cases	lb.	—
Pumice, ground, bbls	lb.	.05
Quartz, powdered	ton	—
Official	oz.	—
Rosin, bbls.	lb.	.08
Rouge, nickel, 100 lb. lots	lb.	.40
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.14
Sal Soda	lb.	.03
Silver Chloride, dry	oz.	1.43
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.62¾
Soda Ash, 58%, bbls	lb.	.03½
Sodium—		
Biborate, see Borax, bbls	lb.	.10½
Bisulphite, tech. bbls	lb.	.09
Cyanide, 96 to 98%, 100 lbs	lb.	.35
Hydrate (Caustic Soda) bbls	lb.	.06½
Hyposulphite, kegs	lb.	.06
Nitrate, tech., bags	lb.	.07
Phosphate, tech., bbls	lb.	.06
Silicate (Water Glass) bbls	lb.	.03
Sulpho Cyanide	lb.	.90
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.35
Sulphur (Brimstone) bbls	lb.	.04
Tin Chloride	lb.	65
Tripoli Composition	lb.	.02½
Verdigris, see Copper Acetate	lb.	.60
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	1.00
Yellow No. 1	lb.	.60
Whiting	lb.	.10
Zinc, Carbonate, bbls.	lb.	.26
Chloride, 600 lb lots	lb.	.15
Cyanide	lb.	.49
Sulphate, bbls.	lb.	.05

COTTON BUFFS

Open buffs, per 100 sections (nominal).		
12 inch, 20 ply, 64/68, cloth	base,	$54.35
14 " 20 " 64/68, "	"	67.50
12 " 20 " 84/92, "	"	57.95
14 " 20 " 84/92, "	"	78.10
Sewed buffs, per pound		
Bleached and unbleached	"	1.00

FELT WHEELS

		Price Per Lb.
White Spanish—		
Diameter— 8" to over 16"	Thickness—½" and ¾"	$4.00
" 8"	" 1" to 3"	3.35
" 10" to 16"	" 1" to 3"	3.25
" over 16"	" 1" to 3"	3.35
" 8" to over 16"	" over 3"	3.40
Grey Mexican—		
Diameter— 8" to over 16"	Thickness—½" and ¾"	$3.90
" 8"	" 1" to 3"	3.25
" 10" to 16"	" 1" to 3"	3.15
" over 16"	" 1" to 3"	3.25
" 8" to over 16"	" over 3"	3.30

Above are even diameters. Odd diameters 50c advance.